

HORTICULTURAL ABSTRACTS

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HORTICULTURAL ABSTRACTS.

VOL. IV.

MARCH, 1934.

No. 1.

Abstracts. Initialled abstracts in the present number are by J. L. Edgar, W. S. Rogers and H. M. Tydeman.

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Horticultural Abstracts

Vol. IV

March, 1934

No. 1

HORTICULTURE—MISCELLANEOUS.

1. CHITTENDEN, F. J. 634/5
The Royal Horticultural Society's Gardens, Wisley : the first twenty-five years.
J. Roy. Hort. Soc., 1933, **58** : 258-87.

This most interesting article recounts the history and some of the vicissitudes of these now famous gardens. The nucleus of the present gardens has been in the possession of the society since 1904. The activities of the gardens have included the following :—The cultivation of fruits, vegetables, stove, greenhouse and especially hardy flowers and plants, trees, shrubs, etc. ; comparative trials of new and rare varieties of trees, fruits, flowers and vegetables ; experiments in the cultivation and treatment of plants of horticultural as opposed to botanical interest ; trials of horticultural appliances and materials ; the establishment of a school of horticulture and the formation of a practical scientific department with laboratory. Apart from the encouragement of the discovery and introduction to the public of attractive varieties of flowering plants, serious research has been undertaken on pests and diseases of flowers, vegetables and fruit, on pollination and fertility in fruit trees, on manuring, and various cultural operations. A list of 100 of the chief separate reports issued on phases of the above subjects, together with notes on the particular work, concludes the article.

2. KEEBLE, SIR F. 634/5-1.8
Garden fertility : its origin and maintenance. (Masters Memorial lectures, 1932.)
J. Roy. Hort. Soc., 1933, **58** : 235-57.

Draining and liming, thorough and deep cultivation are the prerequisites to successful gardening, after which food materials must be adequately supplied. The writer discusses in detail the results of experiments on pasture land at Jealott's Hill and the probable reasons for these results. It was found that the application of a nitrogenous manure such as nitrochalk or sulphate of ammonia in February caused grass to grow luxuriantly about a fortnight in advance of untreated grass. Data on temperature of soil, availability of nitrates applied during the winter, and temperature at which grass growth will start indicate that the process is as follows. Nitrogen applied at a low temperature becomes changed into a form unusable by plants until a certain saturation point is reached in the soil. After this point has been reached there is more nitrogen than the soil can lock up and it becomes available to the plant roots. It is absorbed by them and manufactured into proteins all ready to induce growth directly the minimal temperature for growth is reached. The precocious growth noted above was in no way set off by any failure of growth later in the season. A plea is also made for the addition of N to fruit tree soils in early spring, since this might be expected to assist materially,

not only in the lavish production of fruit buds and fruit, but also in ample leaf development, for the future strength and health of the tree. The exact time at which it is advisable to add the three main nutrients to garden soils remains still undetermined. The application of farmyard manure would superficially appear to be the ideal. Actually, however, in the first place such manure is yearly becoming scarcer, and secondly the proportion of the three nutrients, N, K₂O, P₂O₅, appears indeed to be satisfactory in farmyard manure, but in point of fact plants vary in their demands for these substances. For instance, the soil intervenes very arbitrarily between the plant and the phosphates, only about half the phosphate given becoming available to the plant. Regarding potash, it is interesting to note that potash does apparently have the same effect as sunlight, at least in the manufacture of chlorophyll in leaves as well as in pigments of apples in countries of only moderate sunlight, such as England.

3. BLACKMAN, V. H. 581.14 : 612.014.44 : 551.52
Plants in relation to light and temperature. Part I. Effects of light. (Masters Memorial lectures. 1933. Part I.)
J. Roy. Hort. Soc., 1934, 59 : 1-12.

Illumination cannot be regarded independently of temperature, the action of the light being affected by the temperature to which the plant is exposed. One of the greatest difficulties in testing the effects of ultra-violet ray glass lies in the fact that such glass is different in other respects also to ordinary glass, such as in the intensity of visible light admitted, or in the admission of more infra-red rays. Careful experiments at the Boyce Thompson Institute show that very little difference is observable in the growth of plants according to whether ultra-violet or other rays are excluded. The direct effect of infra-red rays on the plant is very slight or nil ; indirectly, however, they affect the plant through their action in increasing the temperature. The greatest effect on plant growth is obtained by the visible part of sunlight. The three main effects are shown (1) in the production of chlorophyll and food material in leaves, (2) on rate of growth in stems and leaves, (3) on the form of the plant. For leaf assimilation, rays of longer wave length are of the greatest importance. For growth rate, the blue half of the spectrum is particularly important as also for controlling the form. Plants grown in infra-red light are very abnormal and resemble those grown in darkness. That an optimum of light intensity exists has been shown by physiological investigations on the tomato plant at Cheshunt. These and other results indicate that the reaction of plants to shading would repay further investigation. As regards quality of light, it has been found impossible to grow plants in light deficient in blue rays, but possible in light deficient in red rays. Artificial light seems capable of successful use in the following cases :—(1) in breeding work for quick production of successive generations, (2) in forcing "long day" plants during the short days, (3) as a supplement in the short days of spring. One of the disadvantages of artificial light lies in the very small percentage of the energy which is given off as visible rays, e.g. in Neon light only 5%. Very important work is in progress at Cheshunt, and in Sweden and Holland. Sven Oden of the Agricultural Research Station, Stockholm, makes the following recommendations :—For the intensive cultivation of vegetables in winter a light intensity of 380-700 foot candles, using large incandescent lamps with reflectors for use in the morning and evening during spring and winter ; to obtain the optimum light of day, an intensity of 100-350 foot candles ; and for the illumination of cuttings and seedlings in their early stages 27-100 foot candles. Roodenburg at Wageningen uses largely the Neon discharge tube, this form of lamp allowing a very equal distribution of light.

4. BOSE, R. D. 581.084.2
Application of modern statistical methods to field trials.
Agriculture and Live-stock in India, 1933, 3 : 330-40, bibl. 12.

This paper deals firstly with the importance of preceding large-scale field trials by small-scale trials, so that soil variation may be taken into account. It is important that care should be taken in sowing, cultural treatments, etc., in order to obtain correct results for analysis, and also that the trials should be extended over more than one year to allow for seasonal variations. Soil heterogeneity may be eliminated to some extent by planning the trial to suit the fertility

gradients of the field. Data relating to the correlations of contiguous plots is given, showing that an apparently uniform field may be extremely heterogeneous. The replication of plots reduces the error, and also provides an estimate of the error, the number of replications being dependent on the kind of crop and on soil variation. With regard to size and shape of plots, these are dependent upon the type of crop, and on the degree of accuracy desired. Randomization of plots is essential in so far as it prevents bias in their distribution. This is usually achieved by the use of such random arrangements of plots as the "latin square", in which plots are so distributed that each variety has an equal chance of experiencing any variation in soil fertility. Plot layout is discussed, together with the interpretation of results. The methods elaborated by Student, Engledow and Yule, and Fisher (analysis of variance) are explained and discussed. In conclusion, a brief history of agricultural field trial work in India is given, and it is pointed out that there is still need for greater attention to be paid to the principles of planning field trials and to the analysis of the results. J.L.E.

5. JACKSON, F. K., AND OTHERS.

581.084.2

The design and conduct of field experiments.

Agriculture and Live-stock in India, 1933, 3 : 211-33, bibl. 10.

This paper deals with the technique of field experiments conducted in Indore, this technique being evolved so as to be specially adapted to local conditions. Special stress is laid upon the need for economy in time and labour, consonant with obtaining the maximum of results which can be used directly by the local farmer. An outline of the general lines of arrangement of experiments is given, including the question of application of manures, irrigation and the conservation of rain moisture, methods of cultivation suitable for ordinary farms, rotation of crops, and the behaviour of different varieties in different localities. Labour-saving devices to simplify recording, analysis of records, and filing of records are employed. All records from outside districts are dealt with at the central station; hence, in order that they may be presented in the simplest and most understandable form, all records are taken on prescribed forms (examples given in the appendix), and the statistical analyses of each experiment are also done on detailed forms, Fisher's methods being used. Rothamsted methods are being tested under local conditions. Randomized blocks are used in preference to latin squares to simplify the recording of harvest operations, etc., by unskilled labourers. The question of outskirts is dealt with in relation to dividing them off from the main plots. With the organization described here it has been possible to carry on over 100 field experiments at the same time at several different centres in the neighbourhood. J.L.E.

6. LLOYD, F. E.

581.137.2

The carnivorous plants—a review with contributions.

Trans. Roy. Soc. Canada, 1933, 3rd series, vol. 27, pp. 67, bibl. 77, being the presidential address.

In this fascinating and excellently illustrated study the author deals with the mechanism displayed by various species of carnivorous plants with special reference to the bladderworts. He classifies the mechanisms for convenience as follows:—*Passive Traps*. Pitfalls—*Heliamphora, Sarracenia, Darlingtonia, Cephalotus, Nepenthes*; Sticky fly paper type—*Drosophyllum, Roridula, Byblis*. *Active Traps*. Sticky fly paper with aggressive movement—*Drosera, Pinguicula*; Steel trap type—*Dionaea, Aldrovanda*; Mouse trap type—*Utricularia, Biondaria, Polypompholyx*.

7. VESSELOVSKAYA, M.

633.75

The poppy, its classification and its importance as an oleiferous crop. [Russian—English summary, 22 pp.]

Bull. Appl. Botany, Genetics and Plant Breeding, supplement 56, 1933, pp. 213 + xxii, bibl. 151, of which 46 Russian.

The summary contains synopses of the different chapters:—1. A history of the cultivation and use of *Papaver somniferum* L. Commercial growing for the oil from the seeds is now

concentrated in U.S.S.R., Austria, Czechoslovakia, Hungary and Poland. In Yugoslavia and Bulgaria, Asia Minor, India, Persia, Afghanistan and China it is grown for the production of opium. 2. An account of the variation found in inherited characters. 3. The cultivated forms may be divided into seven ecotypes mainly according to climate, especially as affected by moisture and by duration of daylight. If poppies of one ecotype are transferred to unsuitable climate conditions, they fail. 4. A consideration of previous classifications and proposals for a fresh one based partly on suitability for particular climates. 5. This contains a detailed description of sub-species and varieties. The economic value of these is weighed and notes are given of the area of cultivation. 6. A consideration of wild poppies with reference to the origin of the cultivated form of *P. somniferum*. 7. Regional distribution as an oil producing plant in U.S.S.R. 8. Different varieties and ecotypes vary considerably in seed and oil production. Observations by various authorities on the possible correlation of shape of capsule and oil production are discussed and possible lines, which breeding work might well follow, are suggested.

8. MENDIOLA, N. B. 575.252
A method of plant improvement based on the use of hidden heritable bud variations and those produced through injury.
Philippine Agriculturist, 1933, 22 : 465-508, bibl. 128.

The author suggests that heritable variations in plants may be induced by methods of vegetative propagation. The methods propounded are (1) The vegetative propagation of plants usually propagated by seed, by the application of methods involving the use of parts not used heretofore for propagation purposes. (2) Vegetative propagation of plants now ordinarily propagated asexually by methods involving certain alterations in old practices, such as the use of smaller propagating pieces, the use of more buds from each tree, the use of plant parts not now used in vegetative propagation, the infliction of additional wounds on a cutting or other propagating units, the curtailing of the interval of time between vegetative generations so that cells which ordinarily mature and die may develop into parts capable of being used for propagation. The author supports his theory by copious references to the literature of mutation in plants, but does not state that he himself has succeeded in producing variations by the methods suggested.

TREE FRUITS, DECIDUOUS.

Fruitgrowing in general.

9. HATTON, R. G. 634.1/2
Some important considerations in modern commercial fruit planting.
J. Roy. Hort. Soc., 1934, 59 : 18-36.

To the misguided optimist, who with a small capital, fragmentary knowledge and boundless enthusiasm proposes to take up fruit farming, this article may give pause. Even a knowledge of all the factors in each phase of the business is insufficient, unless by careful observation or experience the would-be grower can correlate these factors and gauge correctly their interaction. The author reviews in turn the various primary problems confronting the planter, shows how they are all connected, and gives valuable practical hints as to their solution. The following are some of the points stressed by him. *Soil and climate.* A knowledge of the potentialities of the soils concerned is essential, as they may vary from acre to acre on the same farm. The fruit soil surveyor's correlations of soil type not only with tree growth but also with kind and variety of fruit suitable and its response to cultivation, are of the utmost value. As regards climate, exposure to the east may result in spring damage or to the south-west in bearing the full brunt of autumn gales. Shelter, moreover, helps pollination. Frost protection and damage need further investigation. *Small fruits.* The choice of the right variety to suit the soil and of specimens free from disease (e.g. virus, etc.) is essential. *Top fruits.* Rootstock investigations

on apples, pears, plums and acid cherries now allow of forecasting the performance and growth of trees in new plantations. The National Mark lists, the knowledge of the County Officer and the accumulating results of the Wisley fruit testing scheme are a good basis for selection of varieties according to soil and cultural conditions. *Planning.* Generally speaking, the area should be large enough to allow of full use of horse and mechanical methods of cultivation. If the plantation is to be mixed, it should only hold the same kind of fruit, and the varieties should be chosen with due regard for rootstock influence and varietal propensities. *Manuring.* Only observation of the requirements of the different varieties in different soils can settle this problem. Very different manuring will be wanted for large green cookers and for choice dessert fruit. This fact must of necessity affect any decision as to inter-planting. *Cultivations.* The exact aim of the grower must always be kept in view. Grassing down may be essential to bring colour into dessert apples, but the trees must be carefully watched in subsequent years and changes adopted in cultivations according to need. Exuberantly growing trees become very subject to pests and diseases, which may sometimes be remedied purely by the omission of cultivations, but subsequently the trees must be watched for the time when cultivations are again essential. The control of pests and diseases is much simpler where inter-planting is not adopted. Such plagues, moreover, as scab and sawfly are primarily associated with particular varieties of apple. Control is therefore more economically carried out if such varieties are planted together. *Cross-pollination.* A mistake to be avoided is the provision of pollination by filler trees which later have to be removed. *Actual layout.* The claims and disadvantages of standard and bush trees and of permanent plantations as opposed to plantations containing filler trees are discussed. Points worth particular consideration are facility of spraying, picking, etc., of cultivating, and the necessity for preserving rootstock influence by keeping the union above ground. Finally, specimen plans are given for two separate planting arrangements of two inter-fertile varieties, Bramley's Seedling and Worcester Pearmain, one of them containing permanent trees only, the other allowing for the removal of filler trees worked on Malling IX (Jaune de Metz) rootstocks, adequate pollination being ensured in both cases for the life of the plantation.

10. REVUE HORTICOLE SUISSE. 634.1/2
 Numéro spécial consacré à l'arboriculture fruitière. (**Special fruitgrowing number.**)
Revue Horticole Suisse, 1933, 6 : 10 : 217-88. (Obtainable from École cantonale d'horticulture Châtelaine-Genève, Switzerland, price Fr. 1.50.)

A symposium based on recent scientific research dealing with the different problems facing the Swiss fruitgrower. Some of the articles may well be found useful to other fruitgrowers, especially those dealing with pollination problems, the building up of the tree to its most desirable form, manuring, rejuvenation of old trees, etc.

11. CHIPMAN, G. F. 634.1/2
Fruit growing in Manitoba, Saskatchewan, Alberta.
Country Guide Ltd. publ., Winnipeg, Canada, 1933, pp. 32.

The author has for long made an extensive study of fruits likely to be successful in the Prairie Provinces. The essential requirement is an extreme hardness to winter cold. In this publication each class of fruit is treated separately and at the head of its section is a list of the suitable varieties, divided into those of "first degree hardness", and those of "second degree hardness". The former category consists of fruits that have proved to be hardy as far north as Saskatoon, Rosthein, Edmonton and the Peace River country. In the latter category are fruits reasonably hardy at Winnipeg and in well sheltered situations as far north as the main line of the C.P.R. Under the heading "recommended for trial" are fruits that have proved hardy at Morden Experiment Station but which have not yet been tested farther north. [See also Abst. 23 of this number.—ED.]

12. GRASOVSKY, A., AND WEITZ, J. 634.11

Apple growing in Palestine.

Palestine Dept. Agr. and Forests agr. leaflets series IV, horticulture, No. 30
(undated, ?1933), pp. 21.

The local varieties of apples will thrive either in the cool mountain regions or in the deep sandy loams of the plains notwithstanding the hot summers. Heavy wet soils are not suitable. European and American varieties succeed mainly in the cooler districts and, besides being more trouble to cultivate, are less appreciated locally than are the sub-acid native varieties. Native varieties were usually propagated from suckers, but the practice of budding is becoming general, particularly in Jewish orchards. The rootstocks used in the country are :—(a) Wild and local apples comprising apple seedlings or suckers collected in the mountains, and some local varieties with inferior fruit. The wildlings are characterized by their vigorous growth and powers of resistance to drought and other adverse conditions and by their small bright leaves and hard fleshless fruit packed with large hard seeds. They sucker freely. The stock is not suitable for scions of all varieties. The tendency is for its scion to overgrow it. Better unions are obtained with the stocks of inferior local varieties such as Khashabi in Acre, Shaashayi in Ramallah and Sukkari in Jerusalem, though even here the scion often develops too fast for the stock. Imported varieties (Grand Alexander, Kaiser Apple, Peasgood Nonsuch) budded on these stocks have formed vigorous and productive trees blooming earlier than is their habit on other stocks. (b) Doucin is suitable for imported varieties but gives poor results with local varieties. (c) Paradise (here meaning Jaune de Metz) is used with imported varieties but is unsuitable for local apples. (d) Quince. Trees on this stock are very dwarf and short lived. They bear early in the second year after budding. It is seldom used. The importance of the stock problem is recognized and is under investigation by the Department of Agriculture and the Jewish Agency : the local apples are considered to be the most promising for Palestine conditions. Cultivation methods are described. Diagrams show the period of bloom in experiment stations at Kiruat-Anavim and Jerusalem. The local apples blossom in early March while the imported varieties do not open till nearly a month later. The rootstocks are not stated in the diagrams. A number of the local varieties are described and illustrated.

13. GREATOREX, F. J. 634.23

Cherry growing in Victoria. No. 2. Care of the trees.

J. Dept. Agr. Victoria (Australia), 1933, 31 : 548-56.

Part 1 of this article dealing with the question of rootstocks for cherries was abstracted in *H.A.*, 1933, 3 : 4 : 442. No. 2 contains instructions for budding, grafting and general cultivation of the trees. These instructions follow ordinary orchard practice of the country, where the trees are grown as bushes on cultivated ground.

14. SHULTIS, A. 634.13

Bartlett pear orchard management.

Calif. Agr. Ext. Service circ. 78, 1933, pp. 46, being contribution from the Giannini foundation of agricultural economics.

Figures of working costs based on 6-year averages in pear orchards are given and discussed. The economic factors are considered and suggestions are made on the most desirable units of land, labour, machinery, for use under any given circumstance in the pear orchard.

15. BUNYARD, E. A. 634.37

The cultivation of the fig.

J. Roy. Hort. Soc., 1934, 60 : 61-6.

Through exigencies of climate in Great Britain the fig usually has to be grown fanwise on a wall, a most unsuitable method from the point of view of fruit production, the ideal form for this being a standard or spreading bush. The author suggests that the same effect, i.e. of horizontal branches, can be obtained by planting a tree in a deep melon frame, and tying the branches to

a horizontal trellis, as melons are grown. The added protection of the glass will also assist materially in the fruiting. Figs fruit on the wood of the current year but most of the fruits seldom have time to ripen. Some of the fruits, however, do not develop but remain over the winter in the form of small fruit "buds" no larger than a grain of pepper. It is from these that the crop is produced in the following year. They are, however, always situated at the tips or least ripened part of the wood and are therefore more susceptible to cold. To produce these buds lower down the shoot where the wood is riper, all the young figs which appear after mid-summer should be rubbed away as soon as visible. At the base of the lower leaves small embryo figs will then be produced, which, being on the well-ripened portion of the shoot, will stand a better chance of surviving the winter. The aspect must be the warmest possible with shelter from the cold spring winds. The soil should contain either natural or added lime and, providing the drainage is good, the fig is not fastidious. All new growth is only from a terminal bud, therefore pruning is only necessary when fresh growth is needed from below. It is suggested that a few branches should be cut back annually to keep the tree well furnished without undue loss of crop. Winter protection, much neglected in England, is very necessary. Bracken tied in the branches will provide this. With wall trees a covering of spruce boughs from which the needles will gradually fall in the spring and so harden the young fruit, is advised. Instructions follow for pot and glasshouse culture. Owing to its hardiness and productivity the Brown Turkey fig is the most useful.

Varieties, Breeding.

16. LUCE, W. A.

634.11 : 581.08 : 631.8

634.13 : 581.08 : 631.8

Apple and pear varieties as affected by location and fertilizer treatment.

North-west Fruit Grower, 1933, 5 : 10 : 4.

Locality is often the deciding factor in the success or comparative failure of an apple variety. Conditions suitable or unsuitable to some important American apples are as follows. *Delicious* should not be planted in localities having extremely long or short growing seasons, on low lands subject to spring frosts or on heavy soils. *Winesap* does less well in extremely late districts, or in districts where autumn frost is likely to cause a heavy fruit drop. *Jonathan* dislikes heavy soils and late districts. *McIntosh* on the contrary should be restricted to late districts. *Golden Delicious* is showing unfavourable colour development on heavy soils and develops growth cracks if picking is delayed. It is adapted to extremes in elevation. *Yellow Newtown* does best on deep rich soils and slopes shaded from the afternoon sun. *Rome* is adaptable to most conditions but colours best on open soils. Of pears, *Bartlett* and *Winter Nelis* are adapted to early sites with rather heavy soils while *Anjou* and *Bosc* on the same soil prefer the higher elevations. Fertilizer requirements may be gauged from leaf area which in Eastern Washington has been found to be increased only by nitrogen-bearing materials. The leafage necessary to induce annual cropping in apples or pears varies considerably with the variety. The inference from this that varieties requiring fewer leaves can do with less nitrogen is working out sufficiently well in actual practice to allow of fairly general rules to be formulated for normal conditions of environment. It is pointed out, however, that besides the leaf area necessary, the time and difficulty of colour development must also be taken into account when estimating the nitrogen required. A comparative ratio of amounts is given for a few varieties (not necessarily applying to any particular orchard). Using sulphate of ammonia on average bearing trees the amounts suggested are, *Winesap* 3 lbs., *Delicious* 2 lbs., *Rome* 2 lbs., *Jonathan* 1 lb., *Yellow Newtown* 3 lbs., and for pears, *D'Anjou* 5 lbs., *Bartlett* 2 lbs. If the trees are in biennial bearing it is not advisable to fertilize before the off year crop. Apples of high colour cannot be forced into heavy leaf area and maximum production without marked reduction in grade of fruit; on the other hand apples and pears without colour requirements can be maintained with a heavier leaf area, thus ensuring a heavier production of fruit.

17. ESELTINE, G. P. van. 634.12
Notes on the species of apples. II. The Japanese Flowering Crab apples of the Sieboldii group and their hybrids.

New York Agr. Exp. Sta. Geneva tech. bull. 214, 1933, pp. 21.

This is a continuation of the writer's work on apple species (*New York tech. bull.* 208, 1933, *H.A.*, 1933, 3:3:283). The classification used is based on Rehder's work, and the English names are those used in "Standardized Plant Names" or those generally accepted by American nurserymen. Botanical descriptions are given of the following species, together with notes of more general interest in each case:—*Malus floribunda* (Japanese Flowering Crab), × *M. Arnoldiana* (Arnold C.), *M. Sieboldii* (Toringo C.), × *M. atrosanguinea* (Carmine C.), *M. purpurea* (Purple C.), × *M. Scheideckeri* (Scheidecker C.), × *M. sublobata* (Zabel C.), × *M. Zumi* (Zumi C.), *M. Sargentii* (Sargent C.), *M. brevipes* (Nippon C.).

18. ANON. 634.1/7
Trials of hardy fruits for commercial purposes.

J. Roy. Hort. Soc., 1933, 59:82-96.

Notes summarize the progress made at Wisley and sub-stations in 1933 on top and small fruits. Among items of particular interest are:—(1) A note on the *scab susceptibility* shown by some 48 well-known apple varieties during three years. A grouping of all varieties examined shows 100 varieties to have been free from scab, 114 slightly infected and 35 varieties heavily infected under Wisley conditions. (2) A *flowering calendar* of apple varieties based on five years' records. (3) *Soft fruit trials* concern strawberries, raspberries, blackberries and allied berries, black and red currants, gooseberries, cobs and filberts. Finally the extremely harmful effects on pollination of top fruits of the cold snap from April 13th to 23rd is recorded.* Of the small fruits only gooseberries and Baldwin black currants were badly affected.

19. RAWES, A. N. 634.11-1.23
Fruit trials at Wisley: some new apples.

J. Roy. Hort. Soc., 1933, 58:396-9.

Full descriptions of fruit and growth are given of Bushey Grove, Ellison's Orange, Millicent Barnes and A. W. Barnes.

20. STEINEGGER, P. 634.11:581.162.3
 Zytologisch bedingte Ei-und Zygotensterilität bei triploiden Apfelsorten.
 (Cytologically induced egg and zygote sterility in triploid apple varieties.)
 Reprint from *Berichte der Schweizerischen Botanischen Gesellschaft*, 1933, 42:
 285-339, bibl. 34.

In diploid apple varieties the formation of the egg apparatus corresponds with the normal type found in angiosperms. In triploid varieties, however, certain deviations from the normal process of development may be observed during the reduction division. Of the triploid varieties examined the reduction division in the archesporium mother cell is abnormal. During diakinesis, metaphase and anaphase, along with paired chromosomes, uni-, bi- and trivalent chromosomes were found. The mature tetrad usually consists of four cells, of which the three nearest the apex of the nucellus usually degenerate while the fourth provides the uninuclear embryo-sac. Occasionally one of the other cells of the tetrad may develop into an embryo-sac or more than four cells may be found to the tetrad. Subsidiary nuclei may arise during subsequent stages till maturity of the embryo-sac. They are apparently reabsorbed during the further development of the egg apparatus. These abnormalities may lead to the death of the female sex apparatus. As a result of the abnormal reduction divisions in triploid varieties, abnormal chromosome complements were found in the egg cells and in the secondary embryo-sac nuclei, thus causing further checks to develop after fertilization. Occasionally the fertilized egg cell and the primary

* The maximum frost recorded at the meteorological station was 18° F. on the night of April 19th. The temperature at the trial grounds was probably lower.

endosperm nucleus showed inability to divide. In other ovules it was possible to detect the development of the fertilized egg cell without the formation of endosperm, or the formation of endosperm without division of the egg cell. The death of the embryo followed both these abnormal types of development. The ripe fruits contained empty, half-filled and full seeds. The apparently empty seeds contained small embryos which had died at an early stage. [From author's summary.]

21. BRITTAI, W. H., AND EIDT, C. C. 634.11-1.523
Seed content, seedling production and fruitfulness in apples.
Canadian J. Research, 1933, 9 : 307-33, bibl. 22.

The behavior of different types of apple crosses was found to be very similar, whether or not emasculation was practiced, indicating that selfing was not a serious factor in the latter case. In both cases it was found that (1) all varieties were fruitful when diploid varieties were used as male parents, though triploid \times triploid crosses sometimes approximated the latter in this respect, and that (2) all varieties, regardless of chromosome constitution, were less fruitful when triploids were used as male parents. Though triploid varieties had a lower seed content than diploids, the seed content within the variety was characteristically greater wherever diploids were used as pollen parents. The results obtained with respect to seedlings were in general agreement with those based on seed alone, the order of production being as follows:—first, diploid \times diploid; second, triploid \times diploid; third, diploid \times triploid; and fourth, triploid \times triploid. No correlation between seed content and weight could be demonstrated in Gravenstein, Baldwin, King and Wagener and a barely significant correlation in the case of Northern Spy. Various morphological abnormalities resulting from imperfect pollination are described. [Exact authors' summary.]

22. ROSCOE, MURIEL V. 634.11 : 576.312.32
The chromosomal constitution of certain cultivated apple varieties.
Ann. Appl. Biol., 1933, 28 : 157-67, bibl. 17.

1. Of the eighteen varieties of cultivated apples studied, fourteen have been found to be diploid and four triploid. 2. Euploidy is characteristic of cultivated apples. 3. The diploid varieties considered are distinguished by regularity of meiosis with normal chromosome distribution. 4. The triploid varieties are distinguished by irregularity of meiosis with unequal distribution of the chromosomes. 5. Certain similarities between the division figures of triploid varieties and hybrid forms are pointed out. 6. It is considered that constitutional rather than environmental factors determine chromosomal behaviour. 7. Homology and a balanced relationship of the chromosomes account for the normal reduction figures in diploid varieties. [Author's summary.]

23. CHIPMAN, G. F. 634.11-1.523
Breeding hardy apples.

Reprint from The Country Guide, Winnipeg, Manitoba, Canada, Dec., 1933, pp. 2.

This is an interesting account on popular lines of the initiation by Saunders in 1885 and the subsequent progress under Macoun of the plant breeding experiments which were to produce apples of high quality able to survive the extreme winter cold of the Canadian prairies. The essential quality of hardiness was obtained by using the Siberian crab as seed parent in the first cross, the pollen parents being the most important varieties of cultivated apples. The resultant progeny produced apples 14 times larger than the seed parent, possessing the hardiness of the crab but also its acidity. Second crosses with the best of these new crabs have since produced medium-sized apples of dessert quality such as Piotosh, Rosilda, Wapella and Traill. These have withstood a winter temperature of 40 degrees below zero F. Third crosses have produced apples equal in size, appearance and taste to the best commercial sorts, but at present the degree of cold which they are able to stand has not been ascertained.

*Propagation.**

24. TUKEY, H. B. 631.53 : 634.11

Plant propagation.

New York State Agr. Exp. Sta. circ. 138, 1934, pp. 24.

All the principal methods of vegetative propagation are described and some are illustrated. In the short section on rootstocks the statement is made that apples may be grown as standards on seedling stocks of local apples. For providing seedling stocks, Ben Davis, Rome Beauty, Whitney, Wealthy, Delicious, Jonathan are satisfactory, Rhode Island, Greening, Baldwin, Gravenstein being inferior.

25. CHADWICK, L. C. 631.535

Studies in plant propagation.

Cornell Univ. Agr. Exp. Sta. bull., 571, 1933, pp. 53, bibl. 31.

The bulletin, to quote the sub-title, discusses "the influence of chemicals, of the medium and of the position of the basal cut, on the rooting of evergreen and deciduous cuttings." The investigation lasted four years during which period more than 80,000 cuttings were handled. A series of tables show the results for each variety tested.

26. SCHWARZ, LUISE. 631.535 : 577.15.04

Wirkung des Warmbades und einiger chemischer Bäder auf das Wurzeltreiben von Stecklingen. (The effect of warm water and chemicals on the rooting of cuttings.)

Gartenbauwissenschaft, 1933, 8 : 285-321, bibl. 10.

These experiments were carried out at Vienna between Easter 1931 and Easter 1933. Different temperatures and lengths of treatments were tried and adequate controls were used. Results, which are tabulated and illustrated, include the following. The trees and shrubs tested may be grouped thus:—(1) Those whose cuttings untreated can only with the greatest difficulty be induced to root during the winter rest period but given a warm bath produce leaves and roots (*Populus canadensis*, *Salix alba vitellina*, *Philadelphus coronarius*, *Viburnum Opulus* and *Deutzia crenata*). The rest period of their roots can be broken by bathing for several hours in water at 33° C. (86° F.). (2) Those whose cuttings are found to strike without any treatment during the rest period of the foliage, here warm water treatment either has no effect or hinders root growth (*Ribes rubrum*, *Ligustrum vulgare*). There is apparently no rest period for the roots in such cases. (3) Those whose cuttings refuse to root during autumn and winter, treated or untreated (*Corylus Avellana*, *Viburnum Lantana*). In plants of group (1) treatment for 12-14 hours at 30° C. during the rest period produced good results. In the case of *Salix alba* and *P. canadensis* a 22-hour treatment was the optimum. It was found that with *P. canadensis* even higher temperatures were equally successful (35-45° C.) (95-113° F.), but the exposure was necessarily much shorter, i.e. for 2 hours at 45° C. The effects of total and partial immersion were compared. Results indicate the possibility of good results from partial immersion in cases where total immersion has proved harmful. In other cases no difference has been found, or results have favoured total immersion. The effect of a partial immersion on buds not immersed varied according to the plant. Bathing in 1-10% solutions of ethyl alcohol, acetone and acetaldehyde during the rest period was only rarely successful in inducing root growth. Warm water and chemical treatments were also tried on cuttings from which the leaves had not previously been removed. Such cuttings of *Alternanthera*, *Achyranthes* and *Iresine* were quite unaffected, those of *Begonia*, *Coleus*, *Lantana*, *Abutilon* and *Salvia* were badly damaged by warm water treatment and only slightly helped by chemical treatment. The rooting of cuttings of *Fuchsia* and *Phlox amoena* was assisted. In the case of numerous *Erica* species, of *Azalea indica* and of the rose, Ulrich Brunner, propagation was greatly facilitated by warm water or chemical treatment. In these plants, moreover, in contrast to *Populus* the treatment was effective during

* See also 8, 13.

the growing period in spring and summer. In the case of leafy cuttings the superiority or the reverse of total immersion depends on the resistance of the leaves, which varies in different plants.

27. HOBLYN, T. N., AND PALMER, R. C. 634.22-1.535.6 : 581.084.2

A complex experiment in the propagation of plum rootstocks from root cuttings, season 1931-32.

J. Pom. Hort. Sci., 1934, 12 : 36-56, bibl. 8.

In confirmation of previous experience of rooting cuttings of these two varieties it was found comparatively easy to propagate Common Mussel but very difficult to propagate Pershore Egg in this way. Cuttings were made on October 29th, December 13th, January 25th, February 27th, March 22nd, and April 15th. Half were planted at once and half bedded in sand until the spring when they were all planted together, i.e. the October and December batches on April 9th, the January, February and March batches on April 13th, and both April lots on the day of making. The winter was rather mild and there was little difference in survival or growth of those made from October to February, but those made in April had a lower survival and made very poor growth. Bedding in sand till the spring was detrimental in all cases. The sizes of cutting made were, length 12 cm. and 6 cm., and diameter 3-6 mm., 6-9 mm. and 9-12 mm. Results indicate that cuttings of about 9 cm. in length and not less than 6 mm. in diameter are likely to give the best results. The layout of the experiment, the methods of making and treating the cuttings and of recording their survival and growth are described in detail. The statistical methods applicable to results of this kind are fully indicated.

28. FRANCOLINI, F. 634.63-1.532

Contributo allo studio sulla moltiplicazione degli olivi. (Propagation of the olive.)

L'Italia Agricola, 1934, 71 : 39-50.

The writer admits that he was until a few years ago a firm believer in the advantages of propagating olives by budding or grafting on seedling rootstocks.* Personal observations and practical experience over some 20 years have now converted him to a belief in the superiority of asexual propagation especially by "ovuli". [These are the rounded growths at the base of the tree, varying in size from a walnut to a large orange. They contain white parenchymatous tissue rich in nutrients and possess dormant buds.—ED.] He describes three trials each lasting some nine years. In the first, 250 young plants raised from "ovuli" were tested against 250 similar plants raised from seed. They were well tested by high altitude, dry summers and rocky ground. At the end of eight years 24 of the latter were still surviving in a poor, diseased state, while of the vegetatively propagated plants 230 were surviving and flourishing. The second experiment was carried out at a lower altitude, but again in rocky, dry soil, such as is generally used for olives, 68 plants from seed being tested against 22 from "ovuli". The growth of the seedlings and of the clonal plants was at first good, but the latter were found to show much more resistance to the drought of the summer following planting, only 10% dying as compared with 40% of the former. Seven years afterwards only 10 of the seedlings still survived and these were in a very poor state, while 20 out of the 22 plants of vegetative origin were in robust health and growing strongly. In the third experiment three types of plant were tested, namely plants propagated from "ovuli", seedlings propagated in ordinary nurseries and showing excellent growth, and seedlings propagated on poor ground similar to that in which the experiment was carried out. In the two last cases [as presumably in the two previous trials, though this is not expressly stated.—ED.] the seedlings were budded with known scions. In this last experiment 35 clonal plants were used, 35 worked seedlings from nurseries and 10 worked seedlings grown on rough, stony, poor ground. Seven years after planting and following an exceptionally dry summer, losses occurred as follows:—of clonal plants 5.7%, of roughly raised "seedlings"

* As stated here and in his book on the olive "*Olivicoltura*", Unione Tip-Editrice-Torinese, 1923, pp. 77-9, where a full description of propagation methods is given.

40% and of nursery raised "seedlings" 65%. The surviving plants from "ovuli" were also of stronger growth than the other survivors. In the following February all the plants were killed by the cold down to ground level, but whereas of the 33 clonal plants 22 later shot up again and are now flourishing, not a single one of the worked seedlings showed any further sign of life. The experiments, though not laid out on the latest statistical lines, would appear to indicate the merits of propagation from "ovuli", at least for planting olive groves on poor ground.

*Rootstocks.**

29. HATTON, R. G. 634.13-1.541.11
"Free" or seedling rootstocks in use for pears : their description, selection, vegetative propagation and preliminary testing.
J. Pom. Hort. Sci., 1933, 11 : 305-34, bibl. 15.

The writer refers to previous accounts of pear stock work at East Malling, including reports on the various quince stocks under trial. The first crops of trees on the various "free" stocks were obtained in 1932 and an exhaustive examination of the records with such stocks is given here. Notes on the general technique of sorting out and estimating the value of a very large number of possible strains should be of great value to workers faced with a similar problem. The author summarizes as follows :—(1) Typical samples of the free pear rootstocks of Europe were examined, and are botanically described. Four more or less distinct species "groups" (A to D) seemed represented. (2) Representatives of the range of variation within these groups were tested for ease of vegetative propagation and some thirteen clonal races established. Certain varieties, which fortunately included some of good pomological performance, propagated much more readily than others. (3) The range of root character in the original parents is described and the rooting habit of the plants subsequently raised vegetatively therefrom discussed. Deep rooting clones from layers are quite common. (4) The results in the nursery of budding these clonal selections with Dr. Jules Guyot pear are described. Differences in amount and stoutness of growth of the trees on separate clones were apparent at one, two and three years. Two rootstocks proved incompatible to the variety used after one year. (5) These trees were tested as half-standards and bush trees under plantation conditions. The complete records of their wood growth, cross section of stem, blossoming and fruit bud formation are presented after six years' growth *in situ*. Striking significant differences in vigour are proved, some series making twice the growth of others. Striking differences in early fruit bud formation and type are demonstrated. Early blossoming and dwarfingness have not necessarily been closely correlated. (6) As a result of these experiences it is useless to try and grade seedling pears on botanical characters, the vigour of the stocks themselves or their root type in order to obtain uniformity. Reliance on clonal races, in countries where trees must be stem worked, remains the only method at present.

30. TUKEY, H. B., AND BRASE, K. D. 634.11-1.541.11
Influence of the scion and of an intermediate stem-piece upon the character and development of roots of young apple trees.
New York Agr. Exp. Sta. tech. bull. 218, 1933, pp. 50, bibl. 75.

The writers give a brief concise review of previous work and opinions on the problem of reciprocal stock : scion influence, paying particular attention to the influence of the scion on the stock. The literature shows that the scion may influence the rootstock in other directions than merely quality of roots and direction and form of roots. Examples are given of possible influences in the following directions :—longevity (evergreens on deciduous stocks), hardiness (roses, citrus, apples), while several instances are quoted of stock : scion effect on fruits, chemical composition, etc. Notes are given on the work of Swarbrick, Roberts, Hatton, Vyvyan, Amos, on "stem effect", i.e. the effect of the stem portion of the rootstock. The aim of the present publication is to discuss the question of stock : scion relations for New York conditions and to determine

* See also 12, 93.

if they are commercially important to the interests of fruit growers in that State, and to report on experiments made. In January 1928, 1,800 seedling French crab piece-roots were root-grafted with 14 apple varieties and clones, in 43 combinations of single and double working. The rootstocks were typical of the normal stocks used, but were specially selected for size and uniformity. The tongue graft was used and the unions wrapped with adhesive grafting tape. Forty single-worked grafts were made of Hyslop, Jonathan, Liveland, Northern Spy, Northwestern Greening, Oldenburg, Tioga, Titovka, Wagener, Wealthy, Winesap, Whitney and Malling IX and Malling XIII. The varieties were selected because of the noticeable differences hitherto observed when they had been used as scions. In addition 40 double-worked grafts of each were made of 29 combinations of the above in which a 2-inch stem-piece of a given variety and clone was inserted between the French Crab root-piece and the top scion. Subsequent observations are discussed. After the first season's growth of both single and double-worked grafts a disposition was evident of the top scion to dominate the root system, whether an intermediate stem-piece of another variety intervened or not. A close correlation was shown to exist between vigour of scion and amount of root development and a disposition of the least vigorous grafts to have roots developing at an acute angle with the vertical. Photographs taken after three growing seasons show that in these experiments the top scion had in some instances an appreciable influence on the growth and character of the rootstock* and of the grafted plant, and also that the intermediate stem-piece had in other instances an effect upon the whole plant. Two major factors seemed to dominate the situation. Where graft unions were excellent the top scion and not the intermediate stem-piece dominated the shape and character of the rootstock. The intermediate sometimes indirectly affected the rootstock by its decided effect on the whole plant as by dwarfing it. Where a dwarf stock was used as scion, intermediate or stock, the effect was to dwarf the entire plant. The authors consider that the most important consideration in double-worked trees is the nature of the union achieved.

31. ANGELI, G. DE. 634.1/2-1.541.11
Il problema del soggetto dal punto di vista genetico. (**Rootstocks from a genetic point of view.**)
L'Italia Agricola, 1934, 71 : 59-72, bibl. 36.

A concise summary of the most important work on the standardization of deciduous orchards by the use of uniform rootstocks raised vegetatively. The author notes that the variation in genetic composition of seedlings means variation in performance, and he ends with a plea for the introduction of the various standardized types and their testing under Italian conditions worked with Italian commercial varieties.

32. WOODHEAD, C. E. 634.11-1.541.11 : 581.144.2
Rooting habit of Northern Spy apple stocks.
New Zealand J. Agr., 1933, 47 : 362-5, bibl. 3.

Rootstock investigations in progress at the Plant Research Station, Palmerston North, New Zealand, have disclosed a difference in habit between Northern Spy rootstocks produced from root cuttings and those produced in the usual way from layers. The stocks grown from root cuttings have strong, almost vertical roots in marked contrast to the slender and horizontal roots of the plants from layers. The difference in vigour of top growth is equally marked, two-year-old plants from root cuttings having an average height and girth of 6 ft. 8 in. and 3½ in. respectively against the 3 ft. 8 in. and 2½ in. of the layered stocks. Four-year-old layered stocks show the surface rooting habit still persisting with very little downward tendency. The author cites Oskamp and Batjer† to show the importance of deep rooting in relation to the vigour and productivity of apple trees. Orchard instructors in New Zealand when collecting root cuttings for the present rootstock survey noticed that the largest trees were invariably the deepest rooted. Northern Spy as a stock in New Zealand has the advantages of immunity

* Rootstock derived from seedling piece root.

† Soils in relation to fruitgrowing in New York. Part II. *Cornell Univ. Agr. Exp. Sta. bull.* 550, 1932.

to woolly aphid, of early bearing and of producing highly coloured fruit. Its one disadvantage is that on certain soils and with certain scion varieties it lacks full vigour to produce a satisfactory sized tree with high cropping capacity. The author hopes that the establishment of a more vigorous type of Northern Spy may be brought about by the use of root cuttings and deprecates any hasty discarding of Spy stock for stocks whose performance under New Zealand conditions is unknown.

33. GRUBB, N. H. 634.23-1.541.11

Cherry stocks at East Malling. I. Stocks for Morello cherries.

J. Pom. Hort. Sci., 1933, 11 : 276-304, bibl. 10.

The results of investigations carried out on sweet cherry (*Prunus Avium*) stocks, Mahaleb (*P. Mahaleb*) stocks and acid cherry (*P. Cerasus*) stocks at East Malling are here discussed and compared with information hitherto available from other sources. Seedling stocks of all three species were found to vary considerably, especially those of *P. Cerasus*. Selected seedling *P. Avium* stocks propagated vegetatively were found to produce measurable differences in the growth, crop and fruits of their Morello scions, while there are already indications that similar differences will be produced by *P. Mahaleb* and *P. Cerasus* stocks. *P. Mahaleb* produced larger trees in the nursery than *P. Avium*. Later, however, they became weaker and more spreading. These two facts confirm Howe's experience.* Trees on *P. Mahaleb* were also found to be more susceptible to brown rot and in the writer's opinion are likely to be shorter lived, a trait which would confirm Hedrick's statements† in his *Cherries of New York*. Trees on *P. Cerasus* were much dwarfed and would appear to be more susceptible to brown rot than those of *P. Avium*. The variability in performance of scions worked on different seedlings of the same species suggests the advisability of using clone material for rootstocks. Different methods of vegetative propagation have been tried and a certain measure of success achieved with all three species.

Nutrition, Manuring.‡

34. MOORE, J. C. 634.13 : 577.1 : 581.192

Biochemical investigations of certain winter pears.

Oregon Agr. Exp. Sta. bull. 316, 1933, pp. 10, bibl. 13.

The four varieties from which pears were analysed were Bosc, Anjou, Winter Nelis and Comice. All fruits were harvested at optimum maturity as determined with the pressure tester and the electrical maturity tester and were then packed and stored at 30° F. Prior to analysis the fruit was removed to a conditioning room having a temperature of 65-70° F. until optimum eating quality had developed. The tests were made on 50 typical specimens of each variety. The methods of analysis are described. The writer summarizes as follows:—Data . . . show that the ash of the pear has a high base value, the fresh tissue of fruits a low "buffer value" and that the pear is a good source for the essential mineral elements, being especially rich in copper. The organic analyses show that the pears are very high in total sugars and crude fibres and relatively low in fats, proteins and waste.

35. BURKE, E., AND MORRIS, H. E. 634.11-1.8

Nutrient elements used by leaves and growth of apple trees.

Plant Physiol., 1933, 8 : 537-44, bibl. 5.

Numerous workers are quoted regarding the relation of nutrition to spring growth and production. Previous results indicate that the greatest call on the plant nutrients occurs about when the tree is in full bloom and the leaves and early growth are very active. Experimental material consisted in this case of two apple trees of nearly equal size and vigour growing near each other and about 20 years old [variety not stated.—ED.]. The tree designated the "dormant" tree was lifted on April 9th, 1930, while dormant, and the other, the "active" tree, on June 11th

* *New York Agr. Exp. Sta. Geneva, bull.* 544, 1927.

† *The cherries of New York*, 1915.

‡ See also 2, 16.

when the leaves had attained their normal size. The material was divided into root, trunk, large limbs, small limbs and twigs. The green weight of each division except the roots was determined before samples were taken for analysis. Samples of the 1926, 1927, 1928 and 1929 growth were also taken for analysis. In addition the leaves and spring (1930) growth were removed from the limbs of the active tree, weighed and sampled. The N, P, Ca, Mg, K, and moisture contents were determined. No attempt was made to remove the entire root system, only enough to provide representative samples being taken. It was found that the active tree made a large demand on the nitrogen supply, reducing the amount stored in all parts of the tree. The colour and size of leaves further indicate that lack of nitrogen in the soil was responsible for sub-normal growth and failure to set fruit. The phosphorus, judging from comparative analysis, would appear to have been sufficient. The percentage of potassium increased in all parts of the tree above the small limbs, but showed a decided decrease in the large limbs, trunk and roots, the percentage in the roots of the active tree being ten times that in the dormant tree. Calcium behaved similarly to nitrogen and magnesium to potassium. The writers conclude that soils carrying apple trees should contain ample supplies of nutrients and be sufficiently moist to keep these supplies available for demands in spring.

36. KNIGHT, R. C. 634.11-1.542-1.547
The influence of winter stem pruning on subsequent stem- and root-development in the apple.
J. Pom. Hort. Sci., 1934, 12 : 1-14, bibl. 7.

Some 500 trees including various combinations of the following varieties :—Bramley's Seedling, Cox's Orange Pippin, Grenadier, Lord Derby, Newton Wonder, Stirling Castle ; and rootstocks :—Malling types I, II, IX and VI, were subjected to different degrees of winter stem pruning. Important points from the author's summary of his observations and measurements of results are as follows :—Root production is decreased, and shoot production is increased by pruning—shoot production may also be decreased if the pruning is very severe.—Pruning induces the development of buds and the age and condition of these appear to influence the weight of new shoots produced. Total stem growth actually decreases as the result of pruning, since the increase in new shoots is more than counterbalanced by the decreased thickening of the old stems, the effort normally directed to the latter being directed to the production of new shoots. Although the root system was affected in size, no evidence was forthcoming that its character was changed by pruning. The ratio of new stem growth to new root growth remained surprisingly uniform under all conditions of pruning. It is suggested that if large extension growth is required, immediate pruning is desirable on newly transplanted trees, even though this will probably entail a curtailment of new root production.

37. THOMAS, W. 634.11-1.8
Absorption, utilization, and recovery of nitrogen, phosphorus and potassium by apple trees grown in cylinders and subjected to differential treatment with nutrient salts.
J. Agr. Res., 1933, 47 : 565-81, bibl. 36.

Stayman Winesap apples on identical clone rootstocks were planted in a clay loam soil in 5 ft. × 5.5 ft. cylinders, and from 1925 to 1927 inclusive applications were made of the pure salts sodium nitrate, monocalcium phosphate and potassium sulphate in different combinations, the annual application per tree being equal to .33 lb. N, .77 lb. P_2O_5 and .4 lb. K_2O . Half the trees were in tillage and half in sod. In October 1927, entire representative trees were removed and analysed. The omission of one element was found to have adversely affected the absorption of the other two elements also, and, except in one case of omission of K, to have resulted in reduced growth and flowering. The effects of any particular element varied according to the elements with which it was associated in the fertilizer. A specific ratio would appear to exist in which the N, P and K absorbed are optimum for growth and reproduction, this being approximately 6 : 1 : 4. This would indicate soil effects, namely leaching of nitrates and high fixing capacities of P and K.

38. PROEBSTING, E. L. 631.4 : 631.874
Effect of cover crops on the soil solution at different depths under orchard conditions.

Hilgardia, 1933, 7 : 14 : 553-84, bibl. 6.

Two earlier papers in *Hilgardia* (1929, 4 : 57 and 1930, 5 : 35) and a paper given at the Xth International Horticultural Congress in 1932 (*Proceedings of the Congress and H.A.*, 1933, 3 : 4 : 474) have already been issued as progress reports on this work at Davis, California. The plot treatments have been lucerne sod, a summer cover crop of mat bean (*Phaseolus aconitifolius*) (the latter being superseded by *Dolichos Lablab* in 1931 and 1932), and winter cover crops of rye and *Melilotus indica*. These were checked against three clean-cultivated strips. Treatments were duplicated. The data of the concentration of NO_3 , SO_4 , HCO_3 , chloride, PO_4 , calcium, magnesium and potassium in soil solutions displaced from 0-2, 2-4, 4-6 and 6-8 foot samples in peach, pear, apricot and prune plots are noted and discussed. As regards the effect on the trees it is stated that after eight years' treatment no certain differences have developed in either growth or fruiting.

39. MANARESI, A., AND RICCI-SIGNORINI, A. 634.1/2-1.874
Sulle culture erbacee consociate nei frutteti. (Cover- and intercropping in orchards.)

L'Italia Agricola, 1933, 70 : 1167-92, bibl. 60.

The article is based mainly on observations in Italy and on American work. The reasons for such crops are summarized thus :—(a) to give shade, (b) to protect from frost, (c) for mulch production and use under the trees, (d) to smother weeds, (e) to increase soil organic content, (f) to increase return per acre. The chief reason in Italy is to get a return on capital while the trees are still unproductive. An examination of the effect of different crops on the growth of young fruit trees indicates that in unirrigated orchards lucerne, beet, potatoes and maize and wheat are definitely injurious, while melons, dwarf beans, onions, tomatoes, etc., do little or no harm and may even help growth. The causes of damage include the removal of nutrient substances and water, and possibly the excretion by the roots of such plants of products harmful to the young fruit trees.

40. MARSHALL, R. E. 634.25-1.84
The effect of time of application of nitrogenous fertilizers on growth and yields, grades and returns of Gold Drop peaches.

Michigan Agr. Exp. Sta. Q. Bulletin, 1933, 16 : 31-4.

The experiments were carried out from 1922 to 1930 on 240 Gold Drop peaches planted in 1921 and 1922 at the Graham Horticultural Station, Grand Rapids. The layout consisted of 12 plots of 8 trees, each plot being separated by guard trees. The four treatments, three times replicated, were :—Nitrogen applied (1) soon after the soil became frost free, (2) just after blossoming, (3) preceding fruit bud formation, (4) early September. Representative dates were April 15th, May 1st, June 10th, September 10th. The applications for all treatments consisted of nitrate of soda applied annually from 1922 ($\frac{1}{4}$ lb. per tree) in increasing amounts until 1926, when for this and succeeding years $2\frac{1}{2}$ lb. per tree were given. The guard trees were unfertilized but were used for pruning studies. Clean cultivation was maintained until late July when an oat cover crop was sown. The fruits were not thinned. The results show a significant increase in yield during the four crop years 1926-30 for trees fertilized in June and September over those fertilized in early or late spring. There is no significant difference between the summer and the autumn fertilizations. In considering the size of fruit it must be borne in mind that Gold Drop has a tendency to produce small fruit and that the fruit was unthinned. Both summer and autumn treatments gave materially and significantly greater yields of peaches larger than two inches in diameter than either of the spring treatments. It may be remarked, however, that a group of unfertilized trees at the end of the orchard, which were treated similarly as regards pruning but were not standing in such a position that they could act as controls, gave an average yield and

financial return equal to the total average yield and return for the fertilized trees of the experimental plot for the same period, a fact which leaves the author in doubt as to whether his experimental trees were in need of nitrogen at all.

Pollination.

41. BOVEY, P. 634.1/2 : 581.162.3
 Floraison et fructification des arbres fruitiers. (**Flowering and fruiting of fruit trees.**)

Reprint from Revue Horticole Suisse, 1933, 6 : 245-54.

This is an account in very simple, understandable language of the more important facts bearing on pollination and failure to obtain pollination in the more important top fruits. Based largely on Kobel's manual (*Lehrbuch des Obstbaus auf physiologischer Grundlage, H.A.*, 1931, 1 : 317) it is primarily addressed to fruit growers in French Switzerland, but contains notes on planting which may well be of use to fruit growers elsewhere.

42. ATWOOD, C. E. 634.11 : 581.162.3
Studies on the *Apoidea* of Western Nova Scotia with special reference to visitors to apple bloom.

Canadian J. Research, 1933, 9 : 443-57, bibl. 9.

Studies made on the wild bees of Nova Scotia in connection with apple pollination investigations are described. Members of the genera *Halictus* and *Andreana* were found, after hive bees, to be the most important pollinators. Life histories of representative species of these genera are given.

43. HOWLETT, F. S. 634.11 : 581.162.3
Self- and cross-pollination studies of apple varieties, particularly Rome Beauty and Gallia Beauty.

J. Agr. Res., 1933, 47 : 523-37, bibl. 20.

Under the best nutritional conditions only 25% to 50% of a full crop was produced by Rome Beauty and Gallia Beauty when selfed. These two varieties, moreover, were found to be only moderately successful pollenizers of one another, results being about the same as after selfing. Effective pollenizers were found to be McIntosh, Jonathan, Golden Delicious, Starking and Red Spy.

44. SCHANDERL, H. 634.23 : 581.162.3
 Ueber eine selbststerile Spielart der Schattenmorelle. (**A self-sterile strain of the shade morello.**) (Lotkirsche.)

Gartenbauwissenschaft, 1933, 8 : 135-45, bibl. 22.

Two forms of this cherry are known. That with round buds is found to bear very well, the other with pointed buds to be unreliable. The writer's trials at Geisenheim show the latter strain to be self-sterile, a fact which necessitates measures to ensure cross pollination. Three pages are concerned with replying to criticisms of a former paper on pollination conditions in West Germany. (*Ibidem*, 1932, 6 : 196, *H.A.*, 1932, 2 : 1 : 23.)

45. KOBEL, F., AND STEINEGGER, P. 634.23 : 581.162.3
 Die Befruchtungsverhältnisse schweizerischer Kirschensorten. (**Pollination of Swiss cherry varieties.**)

Reprint from Landwirtschaftliches Jahrbuch der Schweiz, 1933, pp. 973-1018, bibl. 11.

This article contains the results of pollination trials carried out on 75 cherry varieties in the years 1929-33. During the work some 148,000 artificial pollinations were made. The trials were in connection with a thorough survey of cherry varieties grown in German Switzerland. An

attempt is being made to select a few of the 300 varieties grown as particularly suitable for each district. A first essential is that their pollination requirements should be known. In the trials flower castration was proved unnecessary, as it was found that not a single sweet cherry variety set any fruit after self pollination. In contrast to this the red-skinned sour cherries show perfect self fertility. Six different inter-sterile groups, each consisting of 2-7 varieties, were found among the *Prunus Avium* or sweet cherries. Investigations were made on the Bing Bigarreau as representing a group found in America, in view of the fact that Napoleon Bigarreau belonging to the same group is grown in some parts of Switzerland. The questions of self- and inter-sterility which are closely connected with "variety" ("Sorte") or "strain" ("Spielform"), terms which are apt to be somewhat inexactly used, are discussed. By "variety" is meant the total trees obtained by vegetative propagation from one seedling. Varieties may always be distinguished by numerous characters due to the very pronounced heterozygotic make-up of their ancestors. "Strains" are new types arising by bud mutation. They differ from their parents in one or very few inherited characters. But since pollination characters are inherited, the strains are not affected in this direction by the fact of bud mutation, and as a result strains are inter-sterile with their parents. A description and an illustration are given of a very noticeable case of red cherry bunches appearing on the branch of a black fruited variety. In the latter half of the work the results of pollination trials with 75 varieties are given, together with notes on appropriate pollinizing varieties in each case, due regard being paid to date of flowering.

46. WOODROW, A. W. 581.162.3 : 638.12

The comparative value of different colonies of bees for fruit pollination.

Cornell Univ. Agr. Exp. Sta. Ithaca, Memoir 147, 1933, pp. 29, bibl. 6.

The author gives an interesting account of methods of counting bees as they leave the hive, and of observations on flights at different temperatures from different sized colonies. He concludes that strength of colony seems to be the most important factor in making honey-bees useful in pollination. Established colonies were found to fly more freely under otherwise similar external conditions than did package bees. The minimum temperature at which bees will fly is influenced by colony strength and external factors.

Harvesting.

47. CROCE, F. M. 634.25-1.55

La cosecha de duraznos. (Harvesting peaches.)

Revista Mensual, B.A.P., 1933, 16 : 193 : 17-22.

Part of the article is devoted to methods of determining the moment when the peach is ready for gathering, a matter of importance since the degree of ripeness permissible lessens with the distance from the markets. Colour affords a rough guide although influenced by variety and environment. White-fleshed varieties may be picked when the green base colour begins to change to yellow or cream and the yellow varieties when the colour has reached a lemon shade. There are exceptions, however. The flesh of J. H. Hale, for instance, is still hard after all the green colour has disappeared, while Early Crawford in a similar colour state is soft. The consistency of the pulp is another rough guide. The different stages have been classified as follows:—hard green, hard ripe, and soft ripe. Both these guides are apt to prove unreliable, particularly as an estimation of degrees of colour or hardness must depend on personal judgment which varies with the individual. The author would prefer the use of a pressure tester and suggests that the scale drawn up by M. A. Blake of the New Jersey Experiment Station might be employed with advantage. This adapted to Argentine conditions is as follows:—Under 3 lb. pressure will not support ordinary handling without bruising, 3.5-5 lb. will stand careful handling and immediate consumption in nearby markets, 5-6 lb. can travel 25-50 kilometres and must be consumed within 24 hours, 6-7 lb. can travel 80-160 kilometres and be sold on the following day, 7-9 lb. will travel well to distant markets. Even with the use of the pressure tester varietal idiosyncrasies have to be taken into consideration, for instance at 7-9 lb. pressure Mayflower and Greenboro'

are green and tasteless. The remainder of the article lays down commonsense methods of harvesting and packing.

The following also are noted :—

PIROVANO, A. Sulla autosterilità del più fertile susino. (**The self-sterility of the Burbank plum.**) *L'Italia Agricola*, 1933, 70 : 1081-3, bibl. 9.

TOTTINGHAM, W. E. **Character of hemicellulose in certain fruit trees.** *Plant Physiol.*, 1933, 8 : 559-61.

OTTERSON, H., AND TOTTINGHAM, W. E. **Examination of starch and hemicellulose extracts from apple wood.** *Plant Physiol.*, 1933, 8 : 561-4.

SMALL FRUITS,* VINES, NUTS.

48. PORTER, D. R. 635.615-1.523
Watermelon breeding.
Hilgardia, 1933, 7 : 15 : 585-624, bibl. 23.

Previous work on breeding the *Cucurbitaceae* is reviewed. Notes are then given on the floral structure and flowering habit of *Citrullus vulgaris* and methods of cross-pollination are described and illustrated. Practically all the work detailed here was done with inbred strains of the Klondike variety. The following notes were made on the results of inbreeding experiments :— Plant vigour, i.e. vegetative growth, was not reduced by four generations of inbreeding. Inbreeding tended to equalize and stabilize individual plant vigour. Inbreeding resulted in the isolation of strains producing more or fewer fruits per plant than ordinary commercial stock. It was found possible by inbreeding slightly to increase or decrease total plant yield, i.e. fruit weight and number of fruits. Inbreeding allowed the elimination of strains of undesirable shape, leaving genotypes significantly more uniform than commercial stock. Inbreeding tended to purify individual strains with respect to fruit colour, rind thickness and toughness, flesh colour, texture and sweetness, seed size and seed coat colour. There were indications that relatively low air temperatures and high air humidity from early morning to noon favoured fruit setting. Pollination between 6 a.m. and 9 a.m. resulted in slightly higher percentage fruit set than pollination between 9 a.m. and 12 noon. Fruit setting was better in the case of large than of small varieties. The greater the strength of the runner bearing the pistillate flower, the higher was the set of fruit.

49. DARROW, G. M., AND LONGLEY, A. E. 634.71-1.23
Cytology and breeding of *Rubus macropetalus*, the logan, and related blackberries.
J. Agr. Res., 1933, 47 : 315-30, bibl. 10.

Descriptions are given of the wild trailing blackberries and dewberries of the Pacific Coast (*Rubus loganobaccus*, *R. ursinus* and *R. macropetalus*), and a study of their chromosomes is outlined with special reference to the origin and relationships of the cultivated varieties particularly the logan. A new variety of *R. ursinus* (var. *monophyllus*) is described. *Rubus macropetalus* has 42 chromosomes as its haploid number while *R. loganobaccus* has 21. Plants taxonomically similar to *R. loganobaccus* were found to have 28 or 35 chromosomes. The cultivated variety Ideal Wild, thought to have originated as a cross between *R. macropetalus* and the logan, has 28 chromosomes. The history and cytology of the logan variety are discussed. The chromosome number of the logan was found to be 21. The F_1 seedlings of the selfed logan showed characteristics of the logan and not of the raspberry. Crosses between the logan (21 chromosomes) and Mammoth (21 chromosomes) gave 162 plants that were almost or entirely sterile and 2 that were partially sterile. Out of 8 examined 6 plants had 21 chromosomes and 2 had 35/2 chromosomes. Crosses between the logan and Young (21 chromosomes) gave 148 almost or entirely sterile plants and 21 partially fertile plants. Of 10 plants examined, 9 had 21 chromosomes and 1 had 21/2 chromosomes. When the logan was crossed with Lucretia

* See also 149.

(21 chromosomes), 18 plants were nearly or entirely sterile and 1 partially fertile. Each of the plants examined had 21 chromosomes. Plants believed to be crosses between *R. macropetalus* (42 chromosomes) and the logan gave some perfect flowered fertile seedlings. Other western species (*Rubus spectabilis*, *R. parviflorus* and *R. leucodermis*) have 7 chromosomes each. As the result of their observations the writers conclude that the logan probably originated as a red fruited perfect flowered sport of *Rubus loganobaccus*.
H.M.T.

50. DARROW, G. M. 634.75-1.23
Twelve years of strawberry breeding.
J. Hered., 1933, 24 : 391-402.

In this article the methods employed since 1920 by the strawberry breeders of U.S. Department of Agriculture are discussed. It is hoped in a later article to summarize results. The three original aims were :—(1) a berry of superior dessert qualities suitable for growing in the Eastern States, (2) berries satisfactory for canning, (3) berries suitable for preservation by freezing. The Marshall, unsuitable for growth in the Eastern States, was the standard in the first case, and the Southland, Dorsett and Fairfax have been the result of this phase of the breeding work. As regards canning, the Redheart has been selected as a distinct addition to canning varieties, while the Blakesmore now fills the need for a strawberry that can be preserved by freezing with sugar. *Methods*.—Field pollination has practically been discontinued and most of the crossing is now done in cold or heated greenhouses. The most successful methods of pollination are exactly described, as also the mashing of the pulp in dry sand to separate the seed, the mixture of seed, pulp and sand being then sown at once in flats and pots. The seed is never allowed to dry out. The seedlings are not allowed to become crowded owing to the danger of damping off, but are generally repotted or reflatted when of a convenient size for handling. The varying field planting methods in Maryland, North Carolina and Oregon are detailed. At the beginning of the ripening season elimination takes place of such plants as may be dwarf or subject to mildew, leaf spot, leaf scorch, *Dendrophoma* leaf spots, *Rhizoctonia* root rot or produce little or badly shaped fruit or fruit small or soft or showing poor colour, uneven ripening, etc. The remainder are left to ripen and are studied for dessert quality, firmness, colour, season, etc. A discussion follows on how far disease and pest and high and low temperature resistances need to be considered when selecting for rejection or perpetuation of seedlings.

51. MOOG, H. 634.851
 Beiträge zur Ampelographie IV. (**A contribution to ampelography.**)
Gartenbauwissenschaft, 1933, 8 : 215-38, bibl. 4.

A further article on the botanical characteristics of vines (*H.A.*, 1932, 2 : 3 : 266 and 1933, 3 : 4 : 479). Here the writer describes 17 *Vitis vinifera* vines grown at Geisenheim. These include 7 varieties of French origin, 1 from South Germany and 9 crosses made at Geisenheim.

52. RACAH, V. 634.8-1.541.11
 Un ottimo portainnesti a torto negletto : il 554-5. (**554-5, an excellent but neglected vine rootstock.**)
L'Italia Agricola, 1933, 70 : 985-8.

An account is given of the very excellent results obtained on calcareous soils, even those containing up to 80-85% of lime, by the use of this rootstock. It is by no means new. Introduced by Couderc in 1890 it is known as a *Monticola Riparia*, though this is somewhat misleading. Actually it is a hybrid of *Aestivalis-Monticola* × *Riparia Rupestris*. Its general appearance and brightness of foliage recall *Rupestris du Lot*, and indicate *Monticola* as an ancestor, while *Aestivalis* blood is evidenced by the pink coloration of the tips of the buds. It is more vigorous than *Berlandieri Rupestris* (301A, 219A, 17-37) and shows greater resistance to lime and to drought. Its affinity with the main Tuscan vines, S. Giovese, Trebbiano, Canaiolo and Malvasia, is good.

53. BOUSIN, N.
Investigation on the development of the vine root system. [Russian—English summary and captions to illustrations.]

Levin Acad. Agr. Sci. Grape Res. Inst. bull. 1, 1932, pp. 106.

The roots of vines aged 1, 2, 4, 40 and 60 years on the Crimea Southern Coast were studied by excavation. Callusing and rooting were found to begin at the basal end of the cutting. Shallow planting caused a shallow and constricted root system. Very deep planting checked rooting and gave weak roots. The optimum planting depth was 40-50 cm. The root system of young vines is described as "intensive", i.e. with many small roots. That of mature vines was "extensive", with large roots spreading deep and wide. Three classes of root, superficial, lateral and basal are noted. Loss of many smaller roots and some larger roots by rotting was observed. Very large variation in rooting was found on different soils. It is concluded that the soil conditions are the principal factors influencing the roots, and such conditions must be studied in each area to get rational planting and cultivation methods. W.S.R.

54. MANUEL, H. L., AND LACKIE, N. D. 634.851-1.55
Unproductiveness in Ohanez vines.
Agr. Gaz. New South Wales, 1933, 44 : 816-8.

It is shown that the application of water or nitrogenous fertilizers during the spring months, with consequent over-stimulation of the vegetative growth, have been responsible for a reduction of yield of vines in the Murrumbidgee Irrigation Area.

55. CASTELLA, F. DE. 634.8-2.8
Coulure of grape crop.
J. Agr. Victoria (Australia), 1933, 31 : 524-7.

Among the causes of coulure, which includes failure of the flower to set as well as the dropping of the young berries after setting, are bad weather at flowering time resulting in faulty pollination, and insufficient nutrition of the grapes owing to the competition of the growing tips and of other grape bunches. The phenomenon varies with varieties and with season, and no one treatment can be recommended for all cases. Among remedies which have in certain cases been found most efficacious are :—(1) *Stopping or tipping*. This consists of suppressing the growing tip at or shortly before the moment when its competition is likely to prove harmful. Where failure of the flower to set is feared, the operation should be done just before flowering ; against a later berry fall it should take place rather later. (2) *Ringling*. This has a very potent action in preventing abscission, but whereas it has no weakening effect on some varieties with which it may be used successfully year after year, e.g. the Zante currant, in others such as the sultana adverse effects are noted after a couple of years. In certain vines, moreover, such as the Raisin des Dames, ringling is found to favour millerandage or the production of irregular bunches which contain a number of very small worthless berries. (3) *Bunch control* or removal of some of the bunches where experience has shown them to be excessive. This has proved very successful in free-bearing sorts such as the Gordo, which produces more bunches than it can support. (4) *Withholding irrigation in spring* in cases where tests have shown the presence of sufficient water in the soil to carry the vine through succeeding months. Merjanien, director of the Russian Viticultural station at Anapa, is quoted in support of this measure. He considers that bunch starvation may occur if too much water is sent up by the roots. (5) *Sulphuring*. This is considered by competent authorities to favour setting, though the exact mode of its action is not understood. Sulphur dusting, being primarily used for *Oidium* control, is also found to have a good tonic action on the general health of the vine. (6) Lastly the writer suggests the efficacy of *potash manuring*, where potash deficiency occurs, such treatment having been found most efficacious in France.

56. COLBY, A. S., AND TUCKER, L. R. 634.84-1.542
Some effects of severity of pruning on growth and production in the Concord grape.

Illinois Univ. Agr. Exp. Sta. bull. 393, 1933, pp. 179-206, bibl. 14.

Vines were subjected to different degrees of winter pruning severity in the five years 1924-28. The 4-cane Kniffin system of training was followed. The vines were classified into 7 groups according to degree of pruning severity, the number of nodes left in the respective groups ranging from 20 to 90 in multiples of 10. The vigour of individual shoots increased proportionately with increase in pruning severity. The increased vigour of weak shoots was shown mainly by greater length and of very vigorous shoots by the growth of laterals. The average length of growth per shoot varied inversely with the number of buds left on the vine at pruning. Total yield was much influenced by the severity of the pruning, since by this the possible number of fruit clusters was limited. The degree of severity changed proportionately the vigour of all the shoots on a cane, the more severe pruning increasing the vigour of the shoots, but having little effect on their production. The severer the pruning, the fewer were the inflorescences formed in the buds along the shoots the following summer. Normally the yielding ability of a shoot was largely determined in the bud the previous year, while its vigour was the greater, the fewer the nodes left at pruning. In this experiment, vines pruned to 56-65 nodes produced a profitable yield and the largest number of flower primordia in the buds of the young shoots for the following year's crop.

The following also is noted :—

GRASOVSKY, A., AND WEITZ, J. **Local grape varieties.** *Palestine Dept. Agr. and Forests agr. leaflets, series IV, horticulture, No. 26* (undated, ? 1933), pp. 15, bibl. 5.

57. BURRIER, A. S., AND SCHUSTER, C. E. 634.51
Costs and practices in establishing walnut orchards in Oregon.
Oregon Agr. Exp. Sta. bull. 315, 1933, pp. 50.

An average of 22 trees are planted to the acre and these may be expected to start bearing in the 12th year. The Franquette or similar varieties are used, being nursery grafted on seedling black walnut roots. [English conditions do not, apparently, favour nursery grafting, but by grafting under glass with dormant or soft wood scions it has been found possible to get trees which crop some 5 or 6 years earlier.—ED.] Intercropping is found more satisfactory than the use of filler fruit trees, which are likely to be most profitable in themselves at the time when the health of the walnuts demands their removal to avoid root competition. Strawberries or other small fruit crop, kale or roots may be used for intercropping, provided the basic principle is observed of not allowing the intercrop roots to compete with those of the walnuts for plant food and moisture. A considerable part of the bulletin is taken up with costs and their allocation, but short useful notes on the essential cultural operations are also given.

58. TRAUB, H. P., AND ROMBERG, L. D. 634.521 : 581.162.3
Methods of controlling pollination in the pecan.
J. Agr. Res., 1933, 47 : 287-96, bibl. 7.

The method finally adopted in these experiments in Texas for excluding pollen was to cover the pistillate terminal with a finely woven cloth bag dipped in boiling paraffin of low melting point. The following types of cover were tried :—(1) Large non-ventilated paraffined cloth bags $6\frac{3}{4} \times 13\frac{1}{2}$ inches. (2) The same but ventilated by the insertion of cotton plugs. (3) Small non-ventilated paraffined cloth bags $1\frac{5}{8} \times 3\frac{3}{8}$ inches. (4) As (3) but ventilated. One season's results

indicate that the use of the small paraffined cloth bag with cotton stuffed into the neck to provide ventilation and padding for the tender shoot and the employment of a hypodermic syringe for pollination give an excellent control, better than that afforded by large covers.

59. BARNES, H.
The Queensland nut (*Macadamia ternifolia*).
Queensland Agr. J., 1933, 40 : 415-7.

634.57

The cultivation of this nut is still in its infancy and the propagation of the more suitable types has not made any great headway, indeed it has not yet been decided what the standards should be, though a large sized nut and thinness of shell are obviously desirable. The tree can be propagated by grafting, though not without some difficulty, and by inarching. Nothing is known as to the effect of grafting on the constitution of the tree. For propagation from seed the nuts are sown in seed beds in spring and are kept constantly moist, preferably by means of a mulch. Not more than 60% will germinate and the process will take from one to three months according to thickness of shell. Soaking the nuts in water for two or three days before planting will hasten germination. Transplanting should be done in the following winter. It will be found that the tap root is of considerable length, a plant 12 inches above ground having a tap root of 24 inches. To reduce damage to the roots the bed should be well watered before the plants are lifted. It is important that the roots be kept moist throughout the transplanting process. The leaf area should be reduced to check transpiration. It is suggested that the lower leaves, which usually bunch together, should be entirely removed, together with about half the remainder. Planting distance is 25 feet apart which allows 70 trees to the acre. The trees are productive by the eighth year, reaching the maximum with a production of 50-100 lb. of nuts per tree in the fifteenth year. Experience shows that the size of the nut is improved by an occasional pruning of crowded branches. The shading of newly planted trees during their first summer has been found to prevent much loss. Interplanting among bananas is to be recommended. The trees are then automatically cultivated with the banana, additional cost is practically nil, and when the bananas are worked out, the nut trees are able to look after themselves. The advice often given that macadamias can be usefully planted on poor dry ground is here refuted. Macadamia is a tree of the coastal rain forests and requires in cultivation a fertile well-drained soil. Experiments dealing with a number of aspects of macadamia culture are being undertaken by the Department of Agriculture.

60. MACDANIELS, L. H.
Nut growing in New York State.
Cornell Univ. Agr. Exp. Sta. Ithaca, bull. 573, 1933, pp. 24.

634.5

Low winter temperatures, say—20° F. and lower, short length of growing season and insufficient total summer heat militate against the commercial growth of black walnuts, Persian walnuts, almonds, some kinds of Japanese butter nuts and European hazel nuts. The chestnut, moreover, will survive such disabilities but is too badly attacked by chestnut blight to allow of extensive planting. It is suggested, however, that, where climate allows, chestnuts should be substituted for otherwise useless shade trees and might also be planted to check erosion on steep land. Short notes are given as to preferences of the above and one or two other nuts, and of sites likely to suit them. More than half the bulletin is devoted to their propagation, including choice of rootstocks. Budding or grafting of trees of named varieties is recommended. The Persian walnut can be grafted on *Juglans nigra* with advantage. Stocks recommended for hickory are *Carya ovata*, *C. laciniosa* and *C. cordiformis*, the last named being a quick growing species. Hints are given on growing the required rootstocks from seed. Hazels or filberts are propagated by layering. A full illustrated description is given of the process of patch budding which is the system usually adopted with nuts, while the following types of graft are explained:—Modified cleft grafts, side grafts, splice grafts, and inlay grafts, the last for top working. General cultural hints follow on soil requirements, cross pollination, harvesting and marketing.

PLANT PROTECTION OF DECIDUOUS FRUITS.*

61. STOREY, H. H. 632.753 : 575.113 : 632.8
The inheritance by an insect vector of the ability to transmit a plant virus.†
Amani Memoirs. Contribution from the East African Agr. Res. Sta. (received February 1934), being reprinted from *Proc. Roy. Soc.*, 1932, **B. 112**, pp. 46-60, bibl. 13.
- STOREY, H. H. 632.7 : 575.113 : 632.8
Investigation of the mechanism of the transmission of plant viruses by insect vectors. I.
Amani Memoirs. Contribution from the East African Agr. Res. Sta., being reprinted from *Proc. Roy. Soc.*, 1933, **B. 113**, pp. 463-85, bibl. 15.

The author summarizes the first paper as follows :—(1) Races have been bred of the leaf hopper, *Cicadulina mbila* Naude, which are on the one hand able, and on the other hand unable to transmit the virus of streak disease in the natural process of feeding on maize plants. (2) The crossing of the pure races has demonstrated that the ability to transmit is inherited as a simple dominant Mendelian factor, linked with sex. In the second paper he deals with successful experiments in the mechanical inoculation of insects with plant viruses by means of puncturing the abdomen or leg with a finely pointed needle or glass micro-pipette. It is concluded from these observations that in the active *Cicadulina mbila*, the vector of streak disease of maize, the virus enters the intestine through the mouth and passes thence through the intestinal wall into the blood and that in the inactive race (see above) the cells of the intestinal wall resist the passage of the virus. It is recognized that there may be some secondary mechanism of resistance, nevertheless, in many inactive individuals, once the barrier of the intestinal wall has been passed, the virus behaves as in an active insect. [From author's summary.]

62. SMITH, H. S.,† AND OTHERS. 632.97
The efficacy and economic effects of plant quarantines in California.
Univ. Calif. Agr. Exp. Sta. bull. **553**, 1933, pp. 276, bibl. 223.

The whole problem of plant quarantine is thoroughly discussed in its biological, economic and administrative aspects and the particular problems of the Californian Service are noted. An analysis is made of the administration of quarantine laws to prevent the diffusion or entry of some 38 pests or diseases.

63. FAES, H., AND OTHERS. 632.9
Les traitements effectués contre les parasites des arbres fruitiers, insectes et champignons en 1930 et 1931. (Orchard pest and disease control in 1930 and 1931.)
Reprint from Annuaire agricole de la Suisse, 1933, pp. 17-77.

The report contains comprehensive notes on the treatment of the following mites or insects :—*Eriophyes piri*, *Cheimatobia brumata*, *Hyponomeuta malinella*, *Carpocapsa pomonella*, and of fungi :—*Fusicladium* sp., *Clasterosporium carpophilum*, *Sphaerotheca mors-uvae*. In addition a study has been made of the biology of *Anthonomus rubi* and of *Grapholita funebrana*. Crude naphthalene spread at the rate of 600 kg. a hectare (approximately 534 lb. per acre) has proved very successful against *Melolontha* infestations, preventing the females from egg deposition.

64. TANAKA, S. 634.13-2.4
Studies on black spot disease of the Japanese pear (*Pirus serotina* Rehd.)
Mem. Coll. Agr. Kyoto Imp. Univ. No. **28**, 1933 (Phytopath. ser. 6), pp. 31, bibl. 28.

The causal fungus of this disease which causes considerable damage in Japan and Korea is recognized here as a new species and is described under the name of *Alternaria Kikuchiana*

* See also 149.

† Other articles on the subject are noted on page 33.

‡ Chairman of committee.

Tanaka. Certain pears are highly resistant, others very susceptible. Most of the paper deals with the laboratory study of the disease.

65. MOORE, M. H. 634.11-2.42
Spraying and dusting experiments on the control of apple scab (*Venturia inaequalis*) and apple mildew (*Podosphaera leucotricha*) at East Malling in 1931-32.

J. Pom. Hort. Sci., 1934, 12 : 57-79, bibl. 11.

Trials were carried out on Cox's Orange Pippin trees. Results are tabulated and discussed in relation to weather conditions. Full strength bordeaux having caused excessive scorch, a half-strength mixture was tried but gave inefficient control of scab. Colloidal sulphur gave good control in 1931 but not in 1932. Results with sulphur dust appeared to depend largely on seasonal conditions. It was found useful after blossoming as an adjunct to pre-blossom wet spraying, being very effective against mildew and controlling red spider. Extra post-blossom dustings, as protective agents, were beneficial in the wet summer of 1931. It would appear advisable to use more applications when dusting than when using liquid sprays and to dust prior to infection. Lime sulphur gave good control of red spider, apple mildew and apple scab. Against scab it was less satisfactory when used with gelatine. Fruit drop resulted from post-blossom use of lime sulphur and sulphur dust in 1932, but not in 1931. Notes were made on the influence of rootstock on scab-infection. Bad fruit-russeting in 1932 was probably the result of the pre-blossom interaction on the trees of soft soap with lead arsenate or its derivatives. [From author's summary.]

66. DAVEY, A. E., AND SMITH, R. E. 634.37-2.3/4
The epidemiology of fig spoilage.
Hilgardia, 1933, 7 : 13 : 523-51, bibl. 14.

An investigation on the method of introduction of two specific types of fig spoilage, namely "smut and mould" and "souring" is here described. Smut is due to *Aspergillus niger*, while moulds are characterized by the presence inside the ripe fig of a mass of mouldy material representing various fungus types such as *Alternaria*, *Aspergillus*, *Cladosporium*, etc. Souring is caused by yeasts. *Sterility of immature figs*. The present work establishes the fact that many figs are not sterile just before the opening of the eye and that closed figs may gradually become contaminated during the growing season. It would seem that infection is most likely borne by predacious mites, the possibility of all other vectors being eliminated on various grounds. That mites actually do carry infection still remains unproved. *Smut*. The dried fruit beetle, *Carpophilus*, is probably one of the vectors of smut, but seeing that the disease actually develops in its absence predacious mites again come under suspicion. Predacious mites and thrips seem also to be the only possible vectors of the various moulds, though here, too, proof is lacking. As regards *souring*, it was found that souring yeasts did not enter the fig until after the eye opened and that this time coincided with the appearance of the dried fruit beetle. Moreover, when beetles were excluded no souring occurred. Strong indication was thus given of the agency of this beetle in introducing the yeast germs.

67. SMITH, F. F. 632.654.2
The cyclamen mite and the broad mite and their control.
U.S. Dept. Agr. circ., 301, 1933, pp. 13.

These two mites, *Tarsonemus pallidus* and *T. latus*, severely injure greenhouse and other plants, the former causing distortion of leaves and flowers and the latter crinkling of leaves and stunting of growth. The broad mite is readily controlled by dusting with finely divided sulphur or diatomaceous earth or repeated fumigation with naphthalene or calcium cyanide. The cyclamen mite is not so readily controlled by the above treatments. Both are, however, killed by immersing infested plants for 15 minutes in water heated to 110° F. (25 minutes being necessary for those in the crowns below soil surface) or by vapour heat treatment for 30 minutes at the same temperature. The major crops attacked are only very slightly, if at all, injured in the process.

68. CHRISTIE, J. R., AND STEVENS, N. E. 634.75-2.651.3
Strawberry dwarf.
U.S. Dept. Agr. circ. 297, pp. 8, bibl. 9.

Further light is thrown on strawberry "degeneration" by this paper. Strawberry dwarf, which has in its time had various causes assigned to it*, is here attributed to the nematode, *Aphelenchoides fragariae*, "the same species" which is "believed to cause cauliflower disease and red plant of strawberries in Europe". Infection may be by water, especially when fields are flooded, or more usually by the continual contamination of runner plants from affected mother plants. Control methods advocated include roguing at the time of hoeing, planting on uninfested land and hot water treatment at 118° F. for half an hour, though it is noted that the last treatment necessitates special care with treated plants for some time. [The temperature is some 8° higher than that recommended by Massee for mite treatment* and by Hodson for control of strawberry pests in general.†—Ed.]

69. HARTZELL, F. Z., AND PARROTT, P. J. 632.951.4 : 632.7
Tar distillate emulsions for the control of the rosy aphid and other fruit insects.
New York Agr. Exp. Sta. bull. 636, 1933, pp. 29.

Work during the last 5 years in New York shows that tar distillate emulsions have a high degree of ovicidal efficiency especially against the rosy apple aphid, *Anuraphis roseus*, the black cherry aphid, *Myzus cerasi*, and the bud moth, *Spilonota ocellana*. Trials against the eggs of these and a number of other insect pests are briefly noted.

70. HARTZELL, F. Z. 632.951.4-2.753 : 634.23
Tar distillate emulsions for the control of the black cherry aphid.
New York Agr. Exp. Sta. Geneva bull. 637, 1933, pp. 23, bibl. 14.

Results in New York with 5 different brands indicate that a 4% concentration of tar distillate emulsion is effective and economical for the control of *Myzus cerasi*.

71. HUCKETT, M. C. 632.753 : 632.951.1
The spray value of nicotine supplements for aphids.
New York Agr. Exp. Sta. tech. bull. 210, 1933, pp. 20, bibl. 9.

The spray supplements used in the hope by their substitution of appreciably cutting down the amount of nicotine sulphate necessary, were 3 proprietary soaps, a powdered gum, and 3 mineral and 1 vegetable miscible oils. All except the gum were successful but not to the extent hoped for, and it was not found possible to eliminate by their use the necessity for a fairly high nicotine sulphate dosage to produce high mortality in aphids.

72. HERMS, W. B. 632.78
Deterrent effect of artificial light on the codling moth.
Hilgardia, 1932, 7 : 7 : 263-80.

The use of artificial lighting for an hour before and an hour after sunset—a time covering the peak of the insect's flight—resulted in a considerably decreased attack on the apples of the treated plot, i.e. 14.5% as against 20.0% attack on the check trees outside the area illuminated.

73. NEWCOMER, E. J., AND CARTER, R. H. 632.78
Studies of fluorine compounds for controlling the codling moth.
U.S. Dept. Agr. tech. bull. 373, 1933, pp. 23, bibl. 12.

Under the arid conditions which obtained it was found possible to obtain about the same control with barium fluosilicate, potassium fluosilicate and sodium fluoaluminate, used at the rate of

* Imperial Bureau of Fruit Production. The "degeneration" of the strawberry. Being *Technical Communication* 5, 1934, pp. 29. See 149.

† Hodson, W. E. H. Control of strawberry pests by hot-water treatment of runners. *J. Min. Agr.*, 1934, 40 : 1153-61.

3 or 4 lb. per 100 gallons water plus 1 pint of fish oil or $\frac{3}{4}$ gallon emulsified mineral oil, as with lead arsenate at 2 lb. per 100 gallons. The spray residue was less than that left by the lead arsenate and was as easily removed. It is noted that fluorine compounds should not be used with lime sulphur or with spreaders containing lime.

74. DANIEL, D. M., AND OTHERS. 632.78 : 632.96

Biological control of the oriental fruit moth.

New York Agr. Exp. Sta. Geneva bull. 635, 1933, pp. 27.

The ravages caused by this moth, *Grapholitha molesta*, to peach and secondarily to apple orchards have been greatly checked by the establishment of the dipterous parasite, *Macrocentrus ancylivorus*. After its introduction into Western New York the percentage of parasitism of the infesting larvae rose from 6.63 in 1928 to 25 in 1932, when the larvae themselves were also found in smaller numbers. The technique of rearing both hosts and parasites is described.

75. WIESMANN, R. 632.77 : 634.23

Untersuchungen über die Lebensgeschichte und Bekämpfung der Kirschfliege *Rhagoletis Cerasi* L. I. Mitteilung. (Life history and control of the cherry fruit fly. 1st Communication.) [Summary in German and French.]

Landwirtschaftliches Jahrbuch der Schweiz, 1933, pp. 711-60, bibl. 49.

The life history is minutely detailed and is followed by an account of attempts to control the pest. Entirely satisfactory control methods have yet to be found. Against the larvae none has yet been tried. The removal and composting of the grass sod beneath the cherry trees seems to offer a good and economical method of controlling the pupae. The use of poison bait and of contact powders failed against the fly itself in 1932 owing to excessively rainy weather.

76. MILES, H. W. 632.793 : 634.22

On *Hoplocampa flava* L., the plum sawfly.

Ann. Appl. Biol., 1933, 20 : 722-30, bibl. 13.

A further article on *H. flava*, which now appears to be the species definitely responsible for injury to developing fruits of the plum (see *Ibidem*, 1933, 20 : 429, *H.A.*, 1933, 3 : 4 : 509). This sawfly is shown to be widespread over England. The adult insect is described and the chief differences between it and other British Hoplocampids are noted. Descriptions are given of eggs, incubation period, larvae and various instars. [From author's summary.]

77. YOUNG, P. A., AND MORRIS, H. E. 634.11-2.951.8

Injury to apple by petroleum oil sprays.

J. Agr. Res., 1933, 47 : 505-22, bibl. 38.

Injury followed spraying to control *Cacoeia argyrospila* on apples in Montana. Tests made on Hiberna apple trees indicate that oils only 5-10% sulphonatable are preferable for use on leaves of that variety and that oils for use on buds should preferably be not more than 30-40% sulphonatable. Hints are given on methods of avoiding such spray injury.

78. ROBINSON, R. M., AND HATCH, M. B. 632.951.23 : 634.11+634.13

The removal of lead and arsenic spray residues from apples and pears.

Oregon Agr. Exp. Sta. bull. 317, 1933, pp. 15, bibl. 6.

The writers record attempts to develop methods for cleaning fruit to well below .014 grains lead per pound. They found that both lead and arsenic can be effectively removed by washing in solutions of hydrochloric acid or of sodium silicate. The concentration, temperature and time depend on the amount of oil or wax present on the fruit. A double process is described whereby the sodium silicate solution is used first and is followed by the acid. The use of underneath rubber brushes was found successful. A degumming agent used with the acid was found to help considerably, but owing to excessive foam formation it cannot yet be recommended for commercial use. Various modifications found useful under certain circumstances are discussed.

79. TINCKER, M. A. H. 632.954

Tests of sodium chlorate as a garden weed killer, at Wisley.

J. Roy. Hort. Soc., 1934, 59 : 107-18, bibl. 33, being *Contribution from the Wisley laboratory LXX*.

Results of application at varying times and strengths on different weeds growing in paths and in neglected cultivated ground at Wisley are discussed. Reports of its efficacy in other countries are also noted. A disadvantage is the fact that sodium chlorate is rich in oxygen and therefore, when dry, may act as an aid to combustion. When mixed with certain chemicals such as carbohydrates (sugars, starches, cellulose) or organic fertilizers and agitated it may ignite or even prove explosive. It should, therefore, not be distributed by dirty machines previously used for guano or artificial manures. It may be applied as a dry powder, but its use is particularly recommended as safer in solution at a 2½% concentration (¼ lb. to the gallon) for small weeds, 5% for herbaceous weeds and 10% for particularly troublesome weeds, about 1 gallon to 10 square yards being a suitable dose. It is decomposed in soil and planting may take place in the treated area after an interval of 4 to 6 months and often much earlier. Early autumn application is especially recommended.

80. LING, A. W., AND HAGGARD, A. 632.954

The eradication of weeds of arable land by sodium chlorate.

J. Min. Agr., 1933, 40 : 224-8.

Results of experiments in Herefordshire indicate that sodium chlorate applied in the autumn at 2 cwt. per acre will on heavy loam, very weedy land and used in conjunction with ordinary cultural methods of weed control, eradicate couch grass, creeping bent grass, crowfoot and shallow rooted annuals. Deep rooted plants remain, however, unaffected. The writers consider that its cost, its dangerous nature and its limitations restrict the use of sodium chlorate in general agriculture to special cases.

The following also are noted :—

CHEAL, W. F. **Apple scab spraying experiments in the Wisbech area : the times of application. II.** *J. Min. Agr.*, 40 : 805-8.

KENT, W. G. **A commercial apple-spraying demonstration in 1932.** *J. Min. Agr.*, 1933, 40 : 420-30.

TURNBULL, J. **New methods of spraying fruit trees.** *J. Min. Agr.*, 1934, 40 : 1040-6.

LOEWEL, E. L. Die Auswirkung der Kupferschäden zu den einzelnen Spritzzeiten. (**Copper spray damage at different times of application.**) *Zeitsch. f. Pflanzenkrankheiten u. Pflanzenschutz.*, 1934, 44 : 71-6.

HARPER-GRAY, R. A., AND BROOKS, H. E. **Winter spraying trials against the apple capsid bug in mixed varieties of apple trees.** *J. Min. Agr.*, 1933, 40 : 630-5.

HUTSON, R. **Insect pests of stone fruits in Michigan.** *Michigan Agr. Exp. Sta. special bull.* 244, 1933, pp. 40.

TAKEI, S., AND OTHERS. Über Rotenon, den wirksamen Bestandteil der Derriswurzel I-XIII Mitteilung. (**Rotenone, the active constituent of derris root, notes 1-13.**) *Mem. Coll. Agr. Kyoto Imp. Univ.* No. 23, 1932 (chem. ser. 13), pp. 26, bibl. 54.

MINISTRY OF AGRICULTURE. **Woolly aphid.** *Advisory Leaflet* 187, 1933, pp. 4.

SCHOENE, W. J., AND OTHER. **Economic status of the green stinkbug (*Acrosternum hilaris* Say) with reference to the succession of its wild hosts.** *J. Agr. Res.*, 1933, 46 : 863-6, bibl. 5.

MCDANIEL, E. I. **Important leaf feeding and gall making insects infesting Michigan's deciduous trees and shrubs.** *Michigan Agr. Exp. Sta. spec. bull.* 243, 1933, pp. 70.

- BAKER, H. The obscure scale of the pecan, *Chrysomphalus obscurus*, and its control. *U.S. Dept. Agr. circ.* 295, 1933, pp. 19, bibl. 9.
 CRAFTS, A. S. The use of arsenical compounds in the control of deep-rooted perennial weeds. *Hilgardia*, 1933, 7 : 9 : 361-72, bibl. 6.

VEGETABLE GROWING.

81. ZURBICKI, Z. 635.1/7 : 581.084.1
 New method of arranging experiments with vegetables in sand cultures with flowing solutions.
Plant Physiol., 1933, 8 : 533-8, bibl. 3.

The writer describes very fully a method suggested for the mechanization of flowing sand cultures, which is a modification of Allison and Shrive's method* described by Dickonssar† and would appear to obviate certain of its difficulties.

82. JESSEP, A. W. 633.8
 The cultivation of herbs.
J. Agr. Victoria (Australia), 1933, 31 : 490-96.

Directions are given for cultivating and marketing the following herbs, under Victoria conditions :—thyme, sage, mint, tarragon, marjoram, parsley, lavender.

83. KISSER, J. 581.142/3
 Zur Frage nach Beziehungen zwischen Keimsschnelligkeit u. Geschwindigkeit des Keimlingswachstum. (The relation between germination and rate of seedling growth.)
Gartenbauwissenschaft, 1933, 8 : 336-45.

Experiments with peas, wheat, barley, maize, cucumber and other plants showed that there was no correlation between quickness of germination and subsequent development in any of these plants.

84. BEWLEY, W. F. 631.544.3
 Raising the soil temperatures in glasshouses.
J. Min. Agr., 1934, 40 : 1047-56.

This is a concise account of the more important soil heating experiments conducted at Cheshunt since 1927. Tests were made as far as possible under conditions obtaining in commerce. The first method tested was the use of an electric cable. Increased tomato crop yields were obtained in 1927 and 1928, but investigations in 1929 showed that only one wire remained in working order. In 1930 the cable was replaced. Earlier maturity was evident on plots raised 4° to 5° F. above the control. The greatest increase, about 33%, occurred when the air temperature was 65° F., i.e. about the optimum for glasshouse tomatoes. In 1931 the experiments were extended to cucumbers and in 1932 they were repeated. The chief objection to these systems being high cost, experiments on cost reduction were begun and resulted in the production of heat by means of cheap galvanized steel wire through which a low-voltage current was passed. These wires of 7 strands 14 S.W.G. for tomato houses and 9 strands for cucumber houses proved satisfactory, and heating by them resulted in considerably increased crops, especially in the absence of soil sterilization. The cost remained, however, at $\frac{1}{3}$ d. per unit, still prohibitive for tomato soil heating, although for cucumbers it might possibly leave a margin of profit. These experiments have shown electricity to be particularly useful for horticultural research work where it is essential to maintain a quantity of soil at a certain constant temperature. A good method of doing this is described. They have also shown beyond all doubt the benefits arising

* *Amer. J. Bot.*, 1923, 10 : 54.

† *Agrochemical Experiment Station, Moscow, publ.*, 1928, 14 : 287.

from soil heating, and the rest of this paper is devoted to an account of experiments on soil heating by hot water pipes heated from a boiler. Results suggest that soil heating may to some extent replace soil sterilization. Much of the root trouble, which has in the past made soil sterilization so necessary, is the result of unsuitable physical and chemical conditions. These appear to be overcome by increasing the soil temperature. Certain diseases would not be affected, however, and eelworm attack might possibly become more serious. Still results are so striking as to merit trial on a small scale. The apparatus necessary includes (1) a hot water boiler to provide water at about 140° F., (2) an electric pump with starting device controlled by a soil thermostat, (3) a quantity of 1-inch pipe specially treated to prolong its life in the soil. The greatest benefit might be expected in cold heavy soils. While considerable details are given here, further advice is promised to anyone interested on application to the Research Station, Cheshunt, Herts.

85. WILCOXON, F., AND OTHERS. 632.944 : 547.652.1 : 631.544
Greenhouse fumigation with naphthalene solutions.
Contrib. Boyce Thompson Inst., 1933, 5 : 461-9, bibl. 5.

In a previous article* a method was described for controlling the concentration of naphthalene vapour during fumigation. This entailed drawing on outside air during the process, which is a distinct disadvantage. By the method described here the concentration of vapour is controlled and no air is used from outside, the greenhouse air being constantly recirculated through a saturator containing a naphthalene solution in an inert solvent. Satisfactory control of red spider mite was obtained by fumigating for 14-16 hours without injury to plants usually thought sensitive to naphthalene fumigation by two methods, one involving the use of solutions of naphthalene and oil and the other a solid solution of naphthalene in sulphur. The first method is described here, the second in a previous article.

86. JONES, H. A., AND EMSWELLER, S. L. 635.25-1.523
Methods of breeding onions.
Hilgardia, 7 : 16 : 625-42.

The whole process is here described. As a result of investigations the following plan is suggested as a basis for the improvement and purification of varieties. 1st year, select a large number of commercial bulbs that approach the ideal for the variety. Plant for selfing. 2nd year, self-pollinate with the help of paper bags round the heads. 3rd year, grow progenies of each plant separately. Discard freely those having off-type bulbs, retaining say 25 or 30% and plant these for selfing. 4th year, self-pollinate. 5th year, grow progenies as in 3rd year, discard all that are still segregating for important characteristics. Retain some 10 lines and select the best bulbs from these. 6th year, group all selections and plant in field so that maximum amount of crossing will occur. Mass the seed. 7th year, sow the seed. When crop is mature, choose large bulbs possessing the desirable characteristics for the variety. Thereafter stocks are maintained by selection of desirable bulbs, and by massing. Illustrations and descriptions are given of muslin and cheese-cloth cages used for ensuring maximum crossing of desired selections.

87. ABDEL-SALAM, M. M. 635.52-2.4
Damping-off and other allied diseases of lettuce.
J. Pom. Hort. Sci., 1933, 11 : 259-75, bibl. 19.

The writer describes his experiments made to determine the relationship of soil and air humidity to damping off. This varies with the two most important fungi isolated, namely *Rhizoctonia Solani* and *Pythium* sp. As regards temperature *Pythium* is less affected by it than *R. Solani*, the tomato strain of the latter—which also infects lettuce—being essentially a high temperature parasite and the ordinary lettuce strain a low temperature parasite. While *Pythium* will infect in all soils, the lettuce strain of *R. Solani* is highly infective in leaf mould and loam soils but much less so in sand. The actual methods of penetration by the two species of fungi differ and are here described.

* Hartzell, A., and others. *Contrib. Boyce Thompson Inst.*, 1930, 2 : 512-22.

88. ABDEL-SALAM, M. M. 635.52-2.482

Botrytis disease of lettuce.

J. Pom. Hort. Sci., 1934, 12 : 15-35, bibl. 19.

The spring phase of this disease (*Botrytis cinerea*) causes the most serious damage especially to overwintered seedlings when planted out in the spring. It often kills lettuce overwintering in the open, being largely correlated with frost injury. The author distinguishes the disease from that known as "greasiness" in England, which closely resembles "tip burn" in America. It may often occur in specimens already attacked by greasiness. Abnormally early sowing in autumn appears to favour the incidence of the disease. Again in the trials described here it was found that early planting out in the spring was followed by a higher incidence of disease than later planting out. No fewer than 13 strains of the disease were isolated and it was possible to separate these into two groups, namely a group characterized by profuse development of sclerotia with few conidia, and one in which the strains showed abundant conidia and few or numerous sclerotia. Infection is less in the warm greenhouse than in the cold frame. High humidity, particularly atmospheric, favours attack. Susceptibility of different varieties of lettuce varied. Steeping the overwintered seedlings when transplanting, in 0.5% Uspulun or Nu-green solutions for half to one hour gave promising results. [From author's summary.]

89. RAWES, A. N. 635.61

Some experiments in asparagus cultivation.

J. Roy. Hort. Soc., 1934, 59 : 74-7.

These experiments were prompted by results achieved in California (*Univ. Calif. Agr. Exp. Sta. bull.* 525, 1932, abstracted *H.A.*, 1932, 2 : 3 : 271) to determine the relative merits of male and female plants and of different spacings. So far results in the first year of cropping confirm the Californian findings that male plants produce considerably more saleable stems than the female. As regards spacing, conclusions cannot yet be drawn, but there are indications that there are optimum distances for planting.

90. RICHARDSON, J. K. 635.646-2.48

Egg plant wilt.

Scientific Agriculture, 1933, 14 : 120-30, bibl. 21.

Wilt of egg plants, a disease of general occurrence from which no known varieties are immune, is caused by a fungus tentatively identified as *Verticillium Dahliae* Kleb., a vascular parasite which may be isolated from all parts of the plant, including the seed. The symptoms are a stunted appearance with wilted, chlorotic, and dead foliage. The appearance of flaccid, slightly chlorotic areas on the basal leaves of the plant indicates the onset of the disease. Soon these areas turn yellow and become necrotic and the entire leaf withers and falls. The disease progresses upwards and severely injures or kills the plant. Vascular discoloration has been observed in the roots, main and secondary stems, leaves, fruit pedicels and fruit, though it need not always show in all parts of the plant. The pathogen is capable of producing the typical wilt in plants at soil temperatures between 11° C. and 30° C. but not at 35° C. Definite control was obtained under greenhouse conditions and a retarding effect in the field by the addition to the soil of a ½% solution of mercuric chloride, the dosage being 200 cc. per 7-inch pot or in the field 300 cc. poured round the base of each plant. At least two treatments at less than three week intervals were necessary. Cultures of certain soil organisms which showed an antagonistic reaction to *Verticillium* have proved ineffective as controls when added to the soil.

91. BRUIJN, H. L. G. DE. 635.656-2.1

Kwade harten van de erwten. (Marsh spot of peas.)

Tijdschrift over Plantenziekten, 1933, 39 : 281-318, bibl. 22, being *Med.* 66 of the *Laboratorium voor Mycologie en Aardappelonderzoek*.

The phenomena of the disease and their reaction to various manurial treatments are discussed. The disease is probably physiological and of a complex nature. Thus, although manuring with K alone prevented the disease, it is not simply a disease caused by K deficiency, as the

attack was most severe on the fully manured plots and on those manured with K+N. Control should be obtainable by influencing soil conditions and composition. All measures which hasten maturity will be desirable. In these experiments manuring with K alone effected this.

92. LAMBERT, E. B. 635.8
Effect of excess carbon dioxide on growing mushrooms.
J. Agr. Res., 1933, 47 : 599-608, bibl. 6.

The writer's experiments proved that an accumulation of 5% or more of CO₂ in the air caused abnormal growth, stunting and even death of mushrooms. This was not found in ordinary mushroom houses or cellars except where they had remained closed for 24 hours or more.

The following also are noted :—

CULPEPPER, CH. W., AND MOON, H. H. **Composition of eggplant fruit at different stages of maturity in relation to its preparation and uses as food.** *J. Agr. Res.*, 1933, 47 : 705-17.

HOGGAN, I. A. **Some factors involved in aphid transmission of the cucumber-mosaic virus to tobacco.** *J. Agr. Res.*, 47 : 689-704, bibl. 21.

SAMUEL, G., AND OTHERS. **"Big Bud", a virus disease of the tomato.** *Phytopath.*, 1933, 22 : 641-53, bibl. 13.

QUANJER, H. M. Ueber eine komplexe Viruskrankheit des Tabaks. (**A complex virus disease of tobacco.**) Reprinted from *Phytopathologische Zeitschrift*, 1933, 6 : 325-33, bibl. 18, also issued as *Med. 64 of the Instituut voor Phytopathologie, Laboratorium voor Mycologie en Aardappelonderzoek*, Wageningen, Holland.

SEVERIN, H. H. P., AND FREITAG, J. M. **Some properties of the curly top virus.** *Hilgardia*, 1933, 8 : 1 : 1-48, bibl. 63.

BAILEY, S. F. **The biology of the bean thrips.** *Hilgardia*, 1933, 7 : 12 : 467-522, bibl. 54.

SEVERIN, H. H. P. **Field observations on the beet leafhopper, *Eutettix tenellus*, in California.** *Hilgardia*, 1933, 7 : 8 : 281-350, bibl. 45.

FLOWER GROWING.*

93. FERGUSON, JESSIE. 635.937.34-1.541.11
A botanical study of rose stocks.
J. Roy. Hort. Soc., 1933, 58 : 344-71.

The article opens with an historical review of investigations on rose stocks in Europe since the beginning of the seventeenth century. It is shown that some 20 stocks are in more or less common use to-day. A collection of stocks was started at Reading in 1930 and these have been under observation both budded and unbudded since that time. Confusion in nomenclature was soon found. It is noted that in all cases stocks raised from cuttings were uniform, those from seed very variable. A key is given based on vegetative characters for the identification of the different stocks. An account is given of the writer's cytological investigations of these stocks. Valuable notes are given on propagation, both vegetative and by seed. Cuttings taken just below the node were found to root more freely than those taken through or just above the node. Shield budding was used successfully. The union achieved was subjected to microscopic examination and is illustrated here. A summary of the opinions of representative nurserymen on the merits of the different stocks is followed by a list of characters which should guide one's choice in selecting a rose stock. Finally the author suggests types of trials which could be carried out and would certainly be of the utmost benefit to rose growers.

* See also 1, 7, 17, 26.

94. DARLINGTON, H. R. 635.937.34
New roses.
J. Roy. Hort. Soc., 1934, **59** : 50-60.

The best known varieties grown in England, classed as Hybrid Tea, Polyantha Pompons and Climber roses are here discussed.

95. WEISS, F. E. 635.939.36
On the germination and the seedlings of gentians.
J. Roy. Hort. Soc., 1933, **58** : 296-300, being *Contribution from the Wisley laboratory* LXIX.

The writer has been unable to confirm Ramsbottom's view that a mycorrhizal fungus is necessary for seedling development in the gentian. Derived from work on a large number of varieties his results indicated that such a fungus is unnecessary both for germination and for healthy growth of seedlings, at any rate with the varieties used. He concludes, moreover, that while exposure to frost may be helpful for the germination of seeds when sown in the open, so that autumn or winter sowing may be advantageous, many gentian species germinate readily at 45° to 50° and can then be successfully established by pricking out and cultivating during the summer in frames.

96. GREEN, D. E. 635.939.516-2.452
Antirrhinum rust. A disease new to Great Britain, caused by the fungus *Puccinia Antirrhini* Diet. and Holw.
J. Roy. Hort. Soc., 1933, **59** : 119-26, being *Contribution from the Wisley laboratory* LXXI.

An account is given of the symptoms and botanical character of this disease which was noted in England for the first time last summer. It is already of serious economic importance in the States and much work has already been done there on its control and the varying susceptibility of different varieties. Investigations are now in progress in this country to determine whether the disease can overwinter here and how best to combat it. As a precautionary measure the Ministry advises firstly the burning of all healthy and diseased antirrhinum plants in localities where the disease has occurred, and secondly the spraying of the surface of infected soil with a solution of copper sulphate (1 lb. to 10 gallons water).

97. GOULD, N. K. 635.944-1.531.17
The hot water treatment of narcissus bulbs.
J. Roy. Hort. Soc., 1934, **59** : 78-81.

This treatment which consists in immersion for 3 hours at 110° F. is still found the most successful against eelworms as also against bulb-mites and the larvae of the narcissus fly. It is thought, however, that the treatment may be responsible for the transference of fungous diseases and of the so-called yellow stripe of narcissus. Faulty treatment such as incorrect temperature or duration of treatment, wrong handling, etc., does sometimes effect modifications in flowers and foliage in the following season. A carefully controlled treatment is essential. It is suggested that the best time for lifting bulbs is early in July. When treatment is necessary, experiments at Wisley indicate the desirability of keeping these lifted bulbs 2 or preferably 3 weeks both before and after treatment in a cool, well-ventilated store. Damage does not appear in the second season after the treatment, but treated varieties have been found to grow taller in the second season than the untreated varieties and the ratio of leaf number to flower number has been found to increase. This increase is due to the production of new lateral shoots. It leads directly to more rapid splitting of the bulb which may or may not be an advantage according to variety.

98. STANILAND, L. N. 635.944-1.531.17

The treatment of narcissus bulbs with hot water.

J. Min. Agr., 1933, 40 : 342-55, bibl. 2.

The standard treatment of daffodil bulbs against eelworm by immersion in water heated to 110° F. for three hours is liable to result in distorted flowers or leaves the following season. The experiments described here were specially directed to discovering whether the time of immersion could be reduced, so that injury to flowers at any rate would not occur. It was found that eelworms both outside and inside bulbs could be killed by exposure to a water temperature of 110° F. in 17 minutes and their eggs by exposure for 8 minutes. This temperature was therefore taken as the standard. Large size bulbs of different varieties from infested areas were then subjected to water heated to 110° and the time was determined necessary for the temperature of their centres to rise to 110°. This having been fixed, whole samples were submitted to this length of treatment + 20 minutes to allow for the death of the eelworm, after which they were planted out in the field. As a result practically no subsequent flower injury occurred, while the eelworm was eradicated. A table is given in which are shown for some 30 commercial varieties the measurements of the largest bulbs from a good sample, the time taken to heat the centres to 110° with water at 110°, and a convenient round time for which such bulbs should be immersed to ensure freedom from pest coupled with satisfactory flowering the following year. The times range from $\frac{3}{4}$ hour to 3 hours, the average being about 1 hour.

99. BARTON, LELA V. 635.936.751

Seedling production of tree peony.

Contrib. Boyce Thompson Inst., 1933, 5 : 451-60, bibl. 9.

Tree peony seeds were successfully germinated at a daily alternating temperature of 15° to 30° C. (59°-86° F.), but the seedlings if kept at these high temperatures failed to form shoots. If, however, seedlings 1-3 cm. long were potted and kept at 5°-10° C. (41°-50° F.) for 2 to 3 months, good shoot production followed their transfer to a cool greenhouse kept at about 13° C. (55°-4° F.). The best spring seedling production followed planting in May, June or July, the roots appearing in the summer and the cold winter period breaking the dormancy of the epicotyl for the shoots to break the following spring. Board-covered cold frames gave the best results. Directions are given for treatment, if earlier production is wanted. No attempt was made to treat the seeds to obtain a greater percentage of germination.

100. CLARK, W. A. 635.976.33

Vegetative propagation in cotoneaster.

Trans. and Proc. Bot. Soc. Edinburgh, 1932-3, 31 : 2 : 256-61, bibl. 1.

Prostrate shoots of *C. microphylla* generally root if left to themselves. This article deals with the production of roots on cuttings and microscopical observations on the processes involved. Cuttings were inserted in a frame from October till March, and it was found that those inserted in March rooted most successfully. A negative correlation was established between callusing and rooting.

CITRUS AND SUB-TROPICALS.

101. ROBINSON, T. R. 634.323

The origin of the Marsh Seedless grapefruit.

J. Hered., 1933, 24 : 437-9, bibl. 6.

The writer recounts and disposes of a picturesque legend that this grapefruit originated as a broken-off root sprout from an ordinary seedling grapefruit which produced only seedy fruits. Investigations show that the original tree was a seedling growing in Polk County, Lakeland, Florida, and that the excellent quality of its fruit was the reason for its spread. Three other seedling grapefruit trees are known to the writer in Florida, all of which produce practically

seedless fruits. One of them would appear to be the parent tree (vegetative) of the Davis (seedless) variety. A second seedling producing seedless fruit and resembling the Marsh is the Dorothy Seedless, while a third seedless grapefruit locally known as the Perfection has also been found by the writer at Oneco, Florida. The pink-fleshed Thompson is stated to be a mutation of the Marsh.

102. TOXOPEUS, H. J. 634.3 : 575.252
Some cases of bud-variation in citrus observed on Java.
Genetica, 1933, 15 : 241-52, bibl. 18.

The author cites eight instances of bud variations affecting leaves and fruits in the citrus varieties, djiruk keprok (*C. nobilis*), djiruk manis (*C. sinensis*), djiruk sucade (*C. medica*), *C. medica* × *C. decumana*, and in crosses and selfs of the "Japansche citroen" (*C. nobilis* Lour. hybr.). After describing these variations and seedlings raised from normal and variant portions of the affected trees, the author discusses their possible origin. He adduces evidence to show that those Citrus species in which the bud variations occurred were highly heterozygotic. This condition facilitated the occurrence of somatic segregation, and factor or block mutations were able to manifest themselves with greater frequency. H.M.T.

103. YEDIDYAH, S. 634.3-1.541.11
The citrus rootstock problem in Palestine.
Hadar, 1933, 6 : 233-7 and 258-62, bibl. 21.

The article is mainly concerned with the possibility of discovering a more suitable rootstock for the Shamouti (Jaffa) orange than the sour orange stock or sweet lime at present used, or alternatively of discovering some way by which the fruiting trees may be raised direct from cuttings without the intervention of a rootstock. As possible stocks rough lemon, the beledy (native) orange, and the trifoliate stock already under trial at the Mikveh-Israel Agricultural School are not proving satisfactory with the Shamouti orange. Seedlings of numerous other varieties have now been raised there, including a number from ancient but healthy seedling orange trees, this last following the recommendation of Professor Webber. At present it is only possible to differentiate between the vigour of growth of the various varieties, since their uses as stocks will necessarily take some years to ascertain. The possibility of raising rootstocks from apogamic seedlings is discussed and the uses of hybridization in this respect are described. The main interest of the article for those whose citricultural interests lie outside Palestine will be found in the discussion of the work on all aspects of the citrus rootstock problem which has already been done both locally and abroad. In this the author has contrived to be both brief and to the point.

104. SHAMEL, A. D., AND POMEROY, C. S. 634.334-1.542
Eureka lemon pruning test.
Calif. Citrograph, 1933, 18 : 218, 236.

The test was carried out in order to obtain some definite data as a basis for the development of lemon tree pruning practice. Alternate trees in a mature block of 40 Eureka lemons were carefully pruned according to their needs in May 1929. Although all trees were not pruned to the same extent, on the whole the pruning could be termed "rather severe". The condition of the trees before pruning was dense with long sucker-like branches. Compared with the unpruned trees on the same plot the loss of yield from pruning the first year was 65.7%, the second year 22.6%, the third year 15%. On a basis of 80 trees per acre the total loss per acre for the first season was 4,600 lb., for the second season 4,304 lb., for the third season 2,680 lb., or a total of 11,584 lb. There was no appreciable difference in size and quality of fruit from pruned and unpruned trees. Whether the pruning will ultimately benefit the trees sufficiently to enable them to make up the deficit is still to be proved. The authors consider that it is obvious from these experiments that the pruning of lemons on a severe basis should not be undertaken without a very careful consideration of all relevant conditions, including market prices.

105. SHAMEL, A. D., AND POMEROY, C. S. 634.31-1.542.24
Girdling Washington navel orange trees.
Calif. Citrograph, 1933, 18 : 328, 347, 348.

The experiment started in March 1928 and has continued uninterruptedly to the present date. The operation consists of incising the trunk through the bark to the wood in a single encircling cut, direction being maintained by a guide strap buckled round the trunk. The girdling is best performed in May at a time when the blossom on the south side of the tree is dropping, while that on the north side is fully open. The girdles are made an inch apart in successive years, the first cut being 12 inches from the ground. The trees in the experiment were planted in 1903 at Corona, California, are of Washington Navel strain free from disease and of fine physical appearance. Alternate trees in the plots have been treated, the remainder being used as controls. Results have shown a slight increase of yield in girdled trees up to the third successive season, with a pronounced increase in light years. The omission of girdling from trees previously girdled has resulted in a reduction of crop. Continuous girdling after the third year may lead to an increasing loss of crop. This observation is supported by data from trees which have been girdled eleven years in succession. As between girdled and ungirdled trees no marked differences have been found in size or flavour of the fruit or in the appearance of the trees. Differences detectable by chemical analyses are slight (see abstract No. 106). There was no increase in disease in girdled trees.

106. CHURCH, C. G. 634.31-1.542.24
Composition of juice of oranges from girdled and ungirdled trees.
Calif. Citrograph, 1933, 18 : 348-9, being *Food Research Division Contribution* 181.

Examination of the juice of fruit from a number of girdled and ungirdled orange trees growing side by side in the orchards and identically treated throughout showed that the fruit from the girdled trees contained more soluble solids and more reducing sugar. No difference was found in the sucrose content of the juices, but owing to the difference in the reducing sugar the total sugar of girdled fruit juice was higher than from the ungirdled controls. There was no difference in the acidity of the juice and little difference in the solids-acid and sugar-acid ratio. The differences found, though significant, are probably unnoticeable to the taste and therefore need not be considered a factor in the girdling of orange trees. The trees had been girdled by a single knife cut completely round the trunk through the bark to the wood, the treatment having been in force for five seasons.

107. BATCHELOR, L. D., AND SCHOONOVER, W. 634.3-2.1
Present status of citrus mottle leaf studies.
Calif. Citrograph, 1934, 19 : 112 and 132.

About a year ago it was demonstrated in many instances that commercial zinc sulphate applied to the soil would control mottle leaf, at least temporarily. Certain damage to trees occasionally resulted and in any case the process was slow. Spectacular benefits, however, have since been effected by the use of zinc sulphate in combination with hydrated lime as a spray, marked improvements in the trees resulting in a few weeks. The mixture recommended is 10 lb. zinc sulphate (25%), 5 lb. hydrated lime, $\frac{1}{4}$ lb. blood albumin spreader, 100 galls. water. Trees should be thoroughly sprayed but need not be drenched. The omission of the lime causes much spray damage. Combination with other sprays for dual purposes is at present inadvisable.

108. THOMPSON, D. J. 634.3-2.42
Develop method for using zinc for brown rot gummosis.
Calif. Citrograph, 1934, 19 : 65.

The superiority in growth, yield and longevity of lemons budded on sweet orange over those on sour stock is considered by the Leffingwell Citrus Company, California, to outweigh the losses caused by the susceptibility of sweet stock to brown rot gummosis. Zinc sulphate has been found largely to control this disease. It was formerly applied by spreading on the ground close

round the trunks of the trees and was only then effective for a very short time. A new method of application has now been discovered which will, it is claimed, eliminate 90% of the loss from brown rot gummosis. A collar of cheap black building paper reaching from the crown roots below ground to the bud union is fitted closely round the trunk and held in position at the bottom by the soil, at the top by a paper clip. Between the paper and the trunk is poured a mixture consisting of 40% zinc sulphate, 20% hydrated lime, 40% sand. From half to one pound of mixture per young tree is required, the cost of treatment in America being about six cents per tree. The mixture is harmless to the trees, which in some cases have even put out new roots into the zinc material. This method is only used on young trees, but is expected to carry them past the susceptibility age.

109. ROHRBAUGH, P. W. 634.3-2.951.8
Do oil sprays accumulate in the citrus tree ?
Calif. Citrograph, 1933, 18 : 297, 307.

The question of the penetration and accumulation of the oil from petroleum oil sprays in the various parts of the citrus tree is studied to discover whether any permanent damage from these sprays is likely to result. A combination of dyes which stains the petroleum oils red and the natural plant oils blue was used in the examination of sections of leaves and other parts. The following facts were observed. Spray oil does not penetrate all parts of a leaf evenly. Under the upper surface of the leaf it lodges between the cells of the leaf. With the under surface the oil enters through the stomata and pores and is much more evenly distributed. A well emulsified spray penetrates into the leaf much less than looser, quicker breaking emulsions. In the fruit spray oil has not been found to penetrate deeper than the oil glands. Spray oil can penetrate through the bark to the cambium and kill it, but as used in ordinary commercial methods does not penetrate further than two-thirds of the way through the twig. No evidence was found of translocation of oil from leaves to branches. As the tree continually renews its bark and leaves, there is little danger of the accumulation of oil sprays in the tree, provided a standard type of emulsion is used.

110. HELY, P. C. 632.752 : 634.3 : 632.944
Citrus red scale. Experiments with liquified hydrocyanic acid gas fumigation.
Agr. Gaz. New South Wales, 1933, 44 : 823-6.

A comparison of the results obtained by the fumigation of Valencia orange trees infested by *Chrysomphalus aurantii* Mask with liquefied hydrocyanic acid and with calcium cyanide showed a 100% kill for the former as against 99.56% for the latter. The liquid HCN dosage was calculated in cubic centimetres on an equivalent basis to the standard calcium cyanide dosage chart, which is reproduced, and was distributed by means of an atomizer. The covering tents were of light calico, and of heavy calico. With both fumigants the light calico tents gave slightly better results. This was unexpected and is attributed to the possibility that the "caving in" of the lighter tents on the windward side in response to sudden gusts may have diverted the wind currents to some extent, whereas the rigid, tightly stretched walls of the heavier tents may have facilitated the entry of air currents to the interior.

The following also is noted :—

NEL, R. G. A comparison of *Aonidiella aurantii* (red scale) and *A. citrina* (yellow scale), including a study of the internal anatomy of the latter.
Hilgardia, 1933, 7 : 11 : 417-66, bibl. 31.

111. F., G. 633.85
The cultivation of the tung tree in New Zealand.
J. New Zealand Inst. Hort., 1933, 3 : 87-91, bibl. 1.

The cultivation of the tung oil tree (*Aleurites Fordii*) is making headway in New Zealand. The tree has been found to respond most favourably to the following conditions and treatment :— A situation as free as possible from spring frosts should be chosen since the blossoms are very

sensitive to frost, though the tree itself will resist occasional light freezes. In transplanting from the nursery [the best age for this is not stated.—ED.] the taproot must not be injured. Taking this precaution the New Zealand Tung Oil Corporation last July transplanted 80,000 trees with under 1% of failures. The soil should be slightly acid, moist but well drained. A sandy loam underlaid with clay three to eight feet down seems to be the ideal. An alkaline soil appears to be fatal. A rainfall of 30-70 inches uniformly distributed over the months not required for ripening of the nuts is desirable. To prepare a nursery seed bed land previously under cultivation is ploughed and harrowed in spring and sown with a leguminous cover crop, which is turned under in the autumn. Towards the end of the dormant season seed is sown 4 inches deep and 8-12 inches apart in rows 3 feet apart. In the open germination is irregular, taking 30-90 days, under frames germination is materially hastened and becomes uniform. Spot sowing where the trees are to stand 25 feet apart each way (60 to the acre) is suggested for grassland. On fallow land the cost of weeding to protect the seedlings debar this method. In New Zealand methods of manuring are yet to be tested. In Florida a fertilizer containing 5% ammonia, 7% phosphoric acid, 2% potash is recommended to be applied twice yearly at the rate of 10-12 lb. per year per tree of 8-10 years, younger trees getting proportionately less. Green manuring is practised here with success. Yield in commercial quantities should begin in the fifth year, increasing up to twentieth year. The return per acre is estimated at £25-£30 for the tenth year. It is also mentioned that the trees are self-fertile, that pests are unknown at present, that cattle will not eat the leaves, and that high yielding strains can certainly be produced by budding.

TROPICAL CROPS.

112. NOWELL, W., AND EDITORIAL. 633.526.2
***Agave amaniensis* : a new form of fibre-producing *Agave* from Amani.**
Kew Bulletin of Miscellaneous Information, No. 10, 1933, pp. 465-7.

This *Agave* has been cultivated at the East African Agricultural Research Station under the name *A. Lespinassei* Trelease. Mr. Nowell, finding that it did not agree with the original description of that species, sent specimens to Kew, whence they were submitted to Professor Trelease, who considers it to be an undescribed form belonging to the *Zapuze* group. A description drawn up by Mr. Nowell and Professor Trelease is published. Pending a genetical investigation of the group the new form has been given specific rank under the name *Agave amaniensis*. This species, whose origin seems likely to remain obscure, is markedly superior to *Agave sisalana* in rapidity of growth and size of leaf. It achieves a gain over the latter of six to twelve months in the date of first cutting. An increased rate of production is likely to be maintained. Mature leaves have an average length of 150 cm. and have a great practical advantage in the absence of marginal spines. It has not yet been known to pole, and propagation is at present effected by suckers which are produced freely after two years. The fibre compared with sisal fibre is much finer and longer, running from 4-5½ feet in length. Although the average tensile strength of sisal fibres is greater owing to their much greater thickness, when calculated to equal cross sectional area the fibre of *A. amaniensis* has about 1½ times the tensile strength of sisal. The brushed fibre is described as lustrous, white to creamy white in colour with a pleasant soft texture. It is considered that this *Agave* may have an important future as a fibre-producing plant. Small commercial plantings have already been made on estates at Magunga and Amboni.

113. JOSHI, N. V. 633.526-1.874
Kudzu vine (*Pueraria Thunbergiana*).
Agriculture and Livestock in India, 1933, 3 : 586-92, bibl. 2.

The growing of the Kudzu vine is recommended to farmers in dairy tracts in India. It provides a good pasturage or green fodder when generally most needed in April-June. The long tap and side roots, the former penetrating to a depth of 6 feet in within 6 months of planting, help to make

the plant very resistant to drought. The roots have, however, the disadvantage to the cultivator of being difficult to eradicate when the ground is required for other crops, and the pieces left in the ground will cause trouble by shooting again. Plants may be raised from seed (which shows greatly reduced germination if not sown within a month or two of harvesting), or, more usually, from cuttings dibbled in where the plant is to grow. In experiments at Pusa the Kudzu grown on rich land produced 30 tons weight of vegetation per acre per annum and on a poor unmanured plot in close proximity to a mulberry hedge from 18 to 25 tons in four successive years. As fodder it is as rich in protein as lucerne but without the tendency of lucerne to cause looseness of bowels and bloat in horses. As a green manure it is rich in nitrogen and potash and experiments show that it continues to be nitrified slowly but steadily up to the 15th week after addition to the soil. The fibre of the stem has potentialities which should be investigated. It is used by the Japanese in the manufacture of the "grass cloth" of commerce. The roots contain about 40% of starch which can be extracted and used as human food.

114. WOOD, R. C.

633.685

Experiments with yams in Trinidad, 1931-3.*Empire J. Experimental Agr.*, 1933, 1 : 316-24, bibl. 4.

The experiments were carried out at the Imperial College of Tropical Agriculture and were subjected to statistical analysis. *Comparison of varieties of yam (Dioscorea sp.)*.—Of the *alata* types Lisbon confirms the general opinion of its superiority in yield and quality. *D. esculenta*, the Chinese yam, is a heavy yielder and easy to cultivate. Its small regular shape makes it easy to lift, but it is unpopular in the market. Yellow, a *D. cayenensis* type, has a delicate flesh, but the much branched root makes harvesting and storing difficult. *Spacing*.—Improved yields resulted from closer planting in the row. Although there is no direct evidence, it is thought that less than 12 inches between the plants would not be profitable. The plants should be well manured. Reducing the distance between the rows or banks from 5 ft. to 4 ft. gave no significant result. *Propping*.—Highest yields were obtained when the supports were strong bamboo stakes partly trimmed. Alternative, less expensive supports were the stems of growing maize, which resulted in a decrease of 4 tons per acre, against which can be set 3,200 lb. of maize cobs, and stakes of *Gliricidia* which were not always strong enough to carry the weight. *Planting season*.—No advantage was secured by planting in the dry season as is done on the West Coast, nor was mulching in the dry season of any benefit. The author considers the manurial trials as difficult to interpret and merely states that "partially decomposed vegetable matter, such as compost, increases the yield, but additions of raw organic matter may have little effect".

115. EDEN, T.

633.72-1.8

The manuring of tea.*Empire J. Experimental Agr.*, 1933, 1 : 298-306, bibl. 22.

The historical aspect of the manuring of tea is summarized and is followed by an account of current manurial practices in Ceylon, India and Java. The experimental evidence in support of these practices is then discussed and it is found that reliable experimental evidence of their utility is not extensive. The results of certain recent experiments conducted on modern lines are briefly noted. In India nitrogenous manuring over 6 years gave an average of 25% increase in yield, while short term experiments in Ceylon and Java confirmed the results with smaller but substantial increments. Trials in India over 7 years of different forms of nitrogen, both organic and inorganic, showed practically no differences—except where organic nitrogen was applied in the form of sinews, the resulting increment being then very much less than with other forms of nitrogen. In Ceylon 2 years' experiments could detect no differences in yield between organic and inorganic nitrogen. In Ceylon experiments of 3 years and in Java of 14 months have shown no response to potash for reasons at present undetermined. These experiments confirm current tradition. Replicated trials with phosphates have so far been confined to Java and indicate a dubious response to the type of manure. Since tea definitely prefers an acid soil reaction liming is seldom resorted to. Times of application of manures vary

with the local climatic conditions. In N. India with an unproductive winter the problem is to find the optimum period for application during the growing season. Manures applied at five different times between February and July indicated that yield increments lessen if manuring is unduly delayed. In Ceylon and Java manuring is considered in its relation to time of pruning, the problem being whether to manure immediately after pruning or at a later date when the plant is recovering. An experiment in Ceylon showed no significant response to manuring at pruning time. An experiment in frequency of application with single and divided doses applied at three month intervals gave no difference in total yield, but showed marked differences in yield distribution during the season. The determination of the effect of manuring on quality presents formidable difficulties. The Ceylon Tea Research Institute is now working on this problem. The first year's experiment to determine the effect on quality of 40 lb. of nitrogen per acre as against no nitrogen gave no significant results. In conclusion the empiric nature of much of the knowledge of the principles governing tea manuring is stressed. Short term experiments cannot satisfactorily solve the problems of a long term perennial crop with a cropping period limited only by a pruning cycle that extends often to four years or more. A continuous and uniform programme of research is needed without which cumulative effects and progressive deficiencies are practically unresolvable.

116. LEACH, R., AND SMEE, C. 633.72-2.754
Gnarled stem canker of tea caused by the capsid bug (*Helopeltis bergrothi* Reut).

Ann. Appl. Biol., 1933, 20 : 691-706, bibl. 18.

An account of work in 1932. The authors have collected evidence which strongly indicates that this stem canker is caused not by fungi, as was previously supposed, but by the tea mosquito bug, *H. bergrothi*. Previous literature dealing with this canker is first discussed, after which the present experiments and the technique employed are described. The difficulty of poison spraying in tea gardens makes control somewhat difficult. There are, however, certain ecological conditions under which the prevalence of the insect may be anticipated in definite areas, such as bad drainage and nurseries thickly enclosed by jungle grass, and amelioration of these is the first essential. In the second place hand collection of insects as a matter of routine is recommended.

117. KNAPP, A. W., AND OTHERS. 633.74
The kind of cacao the manufacturer wants.
Trop. Agriculturist, 1933, 81 : 240-5, being reprinted from *Official Bulletin Internat. Office Chocolate and Cocoa Manufacturers*, July 1933.

Forastero cacao is recommended as being sure of a large permanent demand. The delicate nature of Criollo renders it unsuitable for manufacturers wishing to produce a standard line in large quantities. *Desirable characteristics*.—The beans should be of large size (if possible less than 400 to the pound), healthy, even; plump and with unbroken shell. They should break into crisp nibs when pressed in the palm of the hand. The odour should be clean and pleasant with no smell of vinegar. Fragments should taste fatty and neither bitter, astringent, nutty, harsh nor sour. Cut lengthways through the centre the bean should be open grained. The colour, which varies with the variety from cinnamon to purple brown, should be bright. Slate or violet colour is a defect. *Undesirable characteristics*.—Germinated beans due to over-ripeness at picking or to incorrect fermentation. This condition is found in West African cacaos rather than in West Indian. Unfermented or underfermented beans; the former is soft and cheesy and the latter peculiarly hard. Both cause trouble in manufacture. Washed beans; these break easily and store badly. Mouldy beans; due mainly to improper drying. Sun-dried cacao is preferred. Cacao artificially dried at a temperature of over 50° C. should be specifically described as artificially dried. Clayed, danced or polished cacao is in no way thereby increased in value. Insufficiently cleaned cacao containing fragments of all kinds of debris is unwelcome, since the manufacturer buys it by weight, and has the expense of cleaning it afterwards. Cacao

infested with grubs. The infestation takes place during storage in the tropics. The authors consider that cacao should never be so stored, but, if this is unavoidable, perfectly clean and well ventilated stores will largely minimize the danger. Beans with a foreign odour which may be due to abnormal fermentation, or derived from the fuel used in artificial drying, or from storage alongside odoriferous materials during transport.

118. HAIGH, J. C. 633.82/84
On the identity of some curry stuffs.
Trop. Agriculturist, 1933, 81 : 283-6.

There is often confusion as to the identity of several curry stuffs (seeds) in common use in Ceylon, since these all belong to the *Umbelliferae* and therefore bear a superficial resemblance. This article describes and illustrates a number of these seeds, pointing out the distinctive differences. The varieties discussed are *Foeniculum vulgare* Mill.=Fennel, *Cuminum Cyminum* L.=Cumin, *Anethum (Peucedanum) graveolens* L.=English Dill, *Anethum (Peucedanum) Sowa* Roxb.=Indian Dill, *Carum Carvi* L.=Caraway, *Carum copticum* Benth. & Hk.f., *Carum Roxburghianum* Benth. & Hk.f., *Pimpinella Anisum* L.=Aniseed.

119. P(YKE), E. E. 633.88-1.535
A note on the vegetative propagation of kola (*Cola acuminata*) by softwood cuttings.
Trop. Agriculture, 1934, 11 : 4.

Cuttings of *Cola acuminata* of vigorous new wood, 4 in. long, rooted in calcareous beach sand in a solar propagator in from six to ten weeks. In all cuttings rooted "a single stout root emerged from the stem just above the lowest point of the oblique cut, and grew downwards at an angle of between 45° and 60° to the vertical, afterwards becoming truly vertical".

120. CHITTENDEN, R. J. 633.912-1.53
The asexual propagation of *Hevea*.
Empire J. Experimental Agr., 1933, 1 : 307-15, bibl. 14.

The article is an epitome of all that is involved in the vegetative propagation of *Hevea* regarded from the estate point of view. The past history and present practice of such operations as selection of bud parents, the proving and selection of clones, the layout of bud-grafted clearings, tapping systems, various methods of budding both in nursery and field, the formation of nursery beds and many other features are summarized under the appropriate sub-headings. The whole presents a concise review of present knowledge as regards clonal rubber.

121. VOLLEMA, J. S. 633.912-1.541.5
What are our latest views regarding buddings as planting materials?
Trop. Agriculturist, 1933, 81 : 223-38. (Translated from the Dutch text in *De Bergcultures*, 1933, 7 : 424.)

The recorded performances over a number of years (ranging from 6-13) of the *Hevea* clones recommended for planting by the research stations of the Dutch East Indies are discussed and the earlier recommendations endorsed or modified. In making the records the performance of each clone not only under experiment station conditions but also under wide differences of plantation environment, has been considered.

122. MURRAY, R. K. S. 633.912-1.541.11
Proved *Hevea* clones. II.* Clones in Malaya and the Dutch East Indies.
Trop. Agriculturist, 1933, 81 : 212-22, being contribution from the Rubber Research Scheme (Ceylon).

A record of the recent performances in their countries of origin of clones imported into Ceylon.

* For Part I, see *Tropical Agriculturist*, 1932, 79 : 25-37.

123. SHARPLES, A., AND GUNNERY, H. 631.541.11 : 635.976.8 + 633.912
Callus formation in *Hibiscus Rosa-sinensis* L. and *Hevea brasiliensis*
 Mull. Arg.

Ann. Bot., 1933, 47 : 827-39, bibl. 6.

The study of the various stages in the union of stock and scion in *Hevea* was rendered difficult because details are obscured by the tannin-like deposits in the callus cells. *Hibiscus Rosa-sinensis* L. is free from this defect and has the additional advantage that it forms alternate layers of hard and soft bast in the bark. The latter can be easily peeled off in layers of varying thickness, allowing the behaviour of the medullary rays throughout the inner bark to be clearly observed. It is shown that in stripped surfaces and cleft grafts on both plants the early development of both bark and wood callus is formed predominantly from the medullary ray system. Cambial activity is not apparent until the callus cushion is completely laid down. In cleft-grafts of *H. Rosa-sinensis* stock and scion contribute equal amounts of callus tissue. The origin of callus tissue from the bark and to a lesser degree from the zone bounding the pith is shown in cleft-grafts. A description is given of the commencement of cambial activity at the points where the ends of the severed cambial ring impinge on the callus cushion and of the ingrowth of the ends of the cambial ring till the two unite in the middle of the callus cushion. The authors consider that the simple method of tissue regeneration described by them will be found to be very common in woody plants.

124. S.S. AND F.M.S. DEPT. AGR. 634.6 + 632.951.1 + 631.35
List of experiments at present in progress at the Government experiment
plantation, Serdang.

S.S. and F.M.S. Dept. Agr. general series bull. 16, 1933, pp. 29.

Among the large number of experiments and their results to date which are briefly summarized in this bulletin are the following. [Reasons of space prevent the setting out of the conditions of the experiments in this abstract.—ED.] *Oil palm : manurial experiments.*—The following treatments all gave improved yields over the untreated controls. (a) 2 lb. calcium cyanamide, 6 lb. rock phosphate, 30% P_2O_5 , 2 lb. kainit; (b) 2 lb. calcium cyanamide, 6 lb. rock phosphate; (c) 6 lb. rock phosphate; (d) 6 lb. basic slag; all per palm. Of these the results following treatment (a) are significant. *Oil palm : artificial pollination.*—Two artificial pollination experiments leading to large increases of yield (over 100%) on the part of the pollinated palms have already been described [*Malayan Agr. J.*, 1926, 14 : 384, and 1931, 19 : 123. *H.A.*, 1931, 1 : 2 : 190]. The conditions are peculiar in each case and too much reliance is not placed on them. A third experiment on different trees to determine the optimum number of female inflorescences to be pollinated on each palm gave a percentage of fruit to bunch of 50% in the unpollinated rows to 70% in the artificially pollinated rows. The number of bunches artificially pollinated per palm (all, twelve or six) appear to have made little difference to the yield. *Oil palm : pruning.*—Although the considerable data have not yet been analysed, the removal of dead leaves only appears to yield better results than "normal" pruning, i.e. the removal of all leaves green or dead below the lowest fruit bunch, at the time of harvesting the ripe bunch. *Epiphytic growth on oil palms* has been found to be harmless during the two years, 1932-3, of the experiment. *Tea : vegetative propagation.*—Tea has been rooted by the etiolation method [*Malayan Agr. J.*, vol. 21, p. 310. *H.A.*, 1933, 3 : 4 : 548]. Further experiments are in progress with the variations of this method, i.e. the production of etiolated shoots from pruned stumps or pegged down bushes. Comparison of behaviour of plants thus produced with seedlings will be made under field conditions. *Coffee* (Liberian and Robusta types) grown under shade of leguminous trees gave a very much lower yield than unshaded coffee, though leaf growth was good. [In Brazil, coffee grown under the shade of eucalyptus trees gave a very much higher yield than unshaded coffee. *H.A.*, 1933, 3 : 4 : 553.—ED.] Bushes on clean weeded land made much better growth than those grown with a low cover crop. *Pineapple manurial trials* with Singapore canning pineapples showed no increase in number of fruits or weight for one year as a result of any of the following treatments :—Full application December 1932, (1) cattle manure

10 tons per acre ; (2) calcium cyanamide 100 lb., basic slag 300 lb. per acre ; (3) calcium cyanamide 100 lb., basic slag 300 lb., sulphate of potash 100 lb. per acre, following a half application of these amounts in June 1932. *Tuba root* (*Derris*).—Five types of *Derris* are undergoing manurial treatments to establish whether the degree of toxicity and the rotenone content are influenced by the application of fertilizers to the soil. Results are at present inconclusive. *Propagation by etiolation*.—The method has been described elsewhere [*Malayan Agr. J.*, 1933, 31: 310, *H.A.*, 1933, 3: 4: 548]. Fruits that root readily without wire are lime (*Citrus medica* var. *acida*), citron (*Citrus medica*) ; fruits that require wire are chiku (*Achras Zapota*), orange (*C. Aurantium*), avocado (*Persea gratissima*), jambu chili (*Eugenia aquea*). Many others are under trial.

125. MACEDA, F. S.

634.61

A study of coconut seedlings in relation to shape of the nuts.*Philippine Agriculturist*, 1933, 22 : 430-41, bibl. 6.

The investigations carried out at the Philippine College of Agriculture were aimed at discovering differences between the seedlings arising from round and from oblong nuts. For the purpose of this study the term "round" was applied to nuts whose polar and equatorial circumferences were equal or nearly so. The term "oblong" means that the length of the nut was greater than its width. Five hundred nuts of each shape and of approximately the same size (determined by water displacement) were used. The final observations were made 12 months after planting. The results were as follows. Round nuts germinated earlier than oblong nuts of equal volume, their seedlings produced more leaves and a greater number of roots, and were heavier. There was no significant difference in percentage of germination between the two types or in the length of the leaves or roots.

126. FOEX, E., AND OTHERS.

634.62-2.4

Deux maladies du dattier. (Two diseases of date palms.)*Direction de l'agriculture et de la colonisation de d'Algerie, service bot., bull. 76*, 1933, pp. 4, bibl. 3, being reprinted from *C.R. Academie des Sciences*, 1933, 196 : 1349-50 and 1567-69.

The Bayoud disease of dates is a destructive fungus disease of the Moroccan Sahara attributed to *Cylindrophora albedinis*. Infection starts in the bases of the leaves, runs rapidly longitudinally upwards through the leaves, and more slowly downwards to the trunk. Lateral progression is slower but sure, and finally the whole leaf is involved. In the end the disease reaches the crown and the tree dies. Certain varieties of dates have a high resistance to the disease amounting to almost total immunity. One variety, Khalt, has been known to suffer from the disease for twelve years and has continued to grow and fruit quite normally. II. Belâat (=strangulation) disease is the name given to a disease hitherto unobserved which has begun to attack the date palms in the Southern Territory of Algiers. Lesions start near the growing point and consist of a moist rot which develops rapidly in the crown of the tree. The more or less ligneous tissues situated immediately below the bud take on a violet red tint, and gradually becoming delignified are finally transformed into a yellow green, water-filled mass of the consistency of cheese. There is a strong smell of acetic acid. This rot progresses downwards towards the base, diminishing in intensity and forming an inverted cone clearly divided by a narrow brown zone from the healthy tissues. The disease has certain resemblances to the Bayoud disease, but instead of beginning with a subterminal leaf it attacks first the base of the central bud, and, whereas the Bayoud for a considerable time will advance only unilaterally, Belâat rapidly involves the whole leaf. In addition, a tree attacked by Belâat is seldom killed outright, but is able to shoot from the base or, more rarely, to break near the crown from subterminal buds. The disease appears analogous to the bud rot of East Indian palms caused by *Phytophthora palmivora*, but presents certain differences which cause the author to suspect a different causal agent.

127. GRASOVSKY, A., AND WEITZ, J. 634.64
Pomegranate growing in Palestine.
Palestine Dept. Agr. and Forests agr. leaflets, ser. IV, horticulture No. 31
 (undated, 1933 ?), pp. 12.

In Palestine pomegranates bear in their third year under irrigation and in their fifth year if not irrigated. Full bearing is reached in from seven to ten years. The yield from irrigated trees is about 2,500-4,000 fruits per dunam (about $\frac{1}{4}$ acre) as compared with 1,000-1,500 fruits when not irrigated. The pomegranate succeeds best in loamy soils, it will grow well in alkaline soils, but quickly succumbs to root rot in heavy and undrained soils. In Palestine the tree is the earliest deciduous tree to come into leaf, it flowers throughout May and June, and the fruits ripen in August and September. Propagation is easily effected by means of cuttings 25-45 cm. long of year-old wood. These are usually planted *in situ*. Two eyes only are left above the soil and even these are sometimes covered with loose earth as a protection from the sun. In some villages it is the custom to "bend the cutting slightly when planting in order to hasten growth". The planting season for cuttings or rooted plants is from December to February, the planting distance under irrigation being $2\frac{1}{2}$ metres. Cultivation consists of ploughing about three times a year and an annual hoeing. Pruning and manuring are seldom practised. The following characters are used in the classification of varieties:—(a) Colour of rind: (i) white and green; (ii) pink or red; (iii) black. (b) Flavour: (i) sweet; (ii) sub-acid; (iii) sour. (c) Colour of arils: (i) white; (ii) pink; (iii) crimson. (d) Seeds: (i) seedless; (ii) tender seeds; (iii) hard seeds. (e) Thickness of rind and quantity of rag.

128. SUTHERLAND, J. B. 634.771/2-2.48
List of hybrid banana plants and immunity to Panama disease.
Ann. Rept. Dept. Agr. Jamaica for 1932, 1933, pp. 19-20.

Thirty-four hybrid bananas resulting from crosses made by the Department of Agriculture, Jamaica, are listed and the majority described. Six have proved to be immune to Panama disease, two are definitely not immune though one of them is resistant. The remainder have not yet completed their disease tests.

129. WARDLAW, C. W. 634.771/773-2.4
Banana diseases. VI. The nature and occurrence of pitting disease and fruit spots.
Trop. Agriculture, 1934, 11: 8-13, bibl. 9.

Pitting disease occurs in Trinidad on Giant Governor and Dwarf Cavendish bananas, remaining localized chiefly on the finger stalks and cushions of the proximal hands. It also occurs in a very mild form on Gros Michel. It is shown that *Piricularia grisea* (Cke.) is the principal fungus associated with pits. Infection occurs mainly through the pathogen being washed down by rain on to the fruit from the bracts and transition leaves where it is early established. However, the simple preventive method of removing the bracts proves ineffective under conditions of high humidity favouring abundant spore production when the air is full of windborn spores. It is a question whether remedial measures would be economic, since the uppermost hands (=bottom hands in the Trade) commonly show wastage due to mechanical injury received during transport greatly in excess of any wastage likely to be caused by finger dropping due to pitting. *Fruit spots* have been considered by different investigators to be of physiological and of fungal origin. In Trinidad the author considers them to be attributable among others to the fungi, *Piricularia grisea* (Cke.) Sacc., *Helminthosporium torulosum* (Syd.) Ashby, *Gloeosporium musarum* Cke. & Massee. Under Trinidad conditions the spots are usually scanty and economically unimportant.

130. HELL, W. F. van. 634.771/3-2.19
 Voorloopige mededeeling omtrent het ontstaan en den bouw van z. g. n. stomata vlekken bij bananen. (*Stomata spots on ripening bananas.*) [English summary.]
Reprint from Landbouwkundig Tijdschrift, Maandblad v. h. Ned Genootschap voor Landbouwwetenschap, 1934, 46, No. 555, pp. 16, bibl. 10 (being *Laboratorium voor Tuinbouwplantenteelt* 20, Wageningen).

Bananas Congo, Dwarf and Gros Michel transported to Europe in a storage temperature of $\pm 13^{\circ}$ C. developed round the stomata after 4-7 days ripening at $\pm 22^{\circ}$ C., small, brown, sunken spots. These increased rapidly in size till by the 14th day the fruit had a very unsightly appearance. [The various stages are photographically illustrated.] Laboratory investigations have shown this disease to be of physiological origin. The cause is still being sought and doubtless lies in the conditions of cultivation, transport or ripening. The purchasing public must be taught to regard these marks as a sign of ripeness and not as a blemish. The author proposes the name "stomata spot" for this disease.

131. WARDLAW, C. W. 634.771/773-2.4
Banana diseases. VII. Notes on banana leaf diseases in Trinidad.
Trop. Agriculture, 1934, 11 : 13-15.

The fungi isolated from various types of banana leaf blemish are enumerated and the methods of isolation described.

132. THOMAS, E. N. M., AND HOLMES, L. E. 634.774 : 581.49 : 581.192
Studies in the morphology and biochemistry of the pineapple. I. The development and structure of the seedling and young plant of the pineapple (*Ananas sativus*).
New Phytologist, 1930, 29 : 199-226.
 HOLMES, L. E. 634.771/3 : 581.49 : 581.192
II. Reserves in the seeds of two genera of the *Bromeliaceae* and of various pineapple hybrids.
Ibidem, 1933, 32 : 382-92, bibl. 17.

The object of the investigations which are recorded here was to follow out the early stages of development of this commercially important plant and to compare them with similar stages of hybrids. In the first article which is profusely illustrated the morphology of the seed is minutely examined, the process of germination is noted and the growth of the seedling submitted to close scrutiny. In the second the food storage products of the seeds of two genera, *Ananas sativus* and *Bromelia pinguens*, were investigated. Eleven varieties of seeds of *Ananas*, mostly hybrids, showed a considerable range in composition—particularly in carbohydrate content—the main food store. *Bromelia* seeds showed a close similarity to those of *Ananas* both in type and in relative quantities of compounds stored. Compared with the average of the *Ananas* seeds *Bromelia* seeds have a low water and total nitrogen content, a fairly low reducing sugar content and a high content of polysaccharide. Environmental conditions were presumably much the same, hence the differences found in the composition of the different seeds are more likely to be due to hereditary than to environmental influences.

133. OLDS, G. D. P., AND DENNETT, J. H. 634.774-1.8
Experimental work in relation to pineapples.
Malayan Agr. J., 1933, 21 : 492-504 ;
 and
 S.S. AND F.M.S. 634.774
Reports of the Field Branch for the year 1932.
S.S. and F.M.S. Dept. Agr. general series bull. 15, 1933, pp. 126-7.

An account of manurial experiments at the Pineapple and Fruit Experiment Station, Lim Chur Kang. Manurial experiments have shown that in order to obtain good yields from

pineapples planted on old pineapple land some form of manuring is essential. There is a definite response in the vigour, early maturity and yield of this plant to dressings of phosphatic manures. The most successful dressings appear to be those containing a complete fertilizer. Planting distance experiments show that with manuring a much closer planting than is usual can be effectively adopted on poor land. Mulching experiments showed the definite superiority of "Pabco Asphaltd Paper" over all other mulches tried. [What these were is not stated.—ED.] Green manuring experiments with pineapples are in progress.

134. DYK, J. W. VAN. 631.874
Kan een geregelde beplanting met groenbemesters in de bergcultures het gebruik van kunstmeststoffen op den duur geheel vervangen? (**Can a system of regulated green manuring take the place of artificial manures in the cultivation of upland tropical crops?**)
De Bergcultures, 1933, 7: 1220-9, bibl. 14.

In a discussion, largely based on the work of recent investigators, of the value of green manuring in the higher elevations in the tropics the following conclusions are reached. Green manuring is not a stable source of nitrogen, being too much at the mercy of soil and climate. It may serve to keep an average yielding crop in condition but it cannot, unfortunately, always be applied when and as required. Crops which have hitherto been maintained in high production by means of a full complement of artificial manures will find green manuring alone an inefficient substitute. Although it has its uses as a partial source of nitrogen, its main importance lies in its effects on the physical condition of the soil, particularly as regards the supply of humus.

STORAGE.

135. KESZLER, H. 664.85.038
Die Beeinflussung der Haltbarkeit des Obstes durch Imprägnierung der Fruchthaut mit fett-, öl-, oder wachshaltigen Stoffen. (**The effect on the keeping qualities of fruit of impregnating the skin with waxy substances.**)
Reprint from Schweizerische Zeitschrift für Obst- u. Weinbau in Wädenswil, 1933, pp. 6.

An account is given of results with a vaseline, fatty mixture called "Fruco" and made by a Basle firm. Among advantages from treatment may be counted decreased loss of moisture, decreased wrinkling, retention of green colour of skin. On the other hand the treatment produced deterioration in taste and the incidence of pathological phenomena.

136. ADRIANO, F. T., AND OTHERS. 664.85.037
Studies on the quick freezing of Philippine fruits and the utilization of the frozen pack products.
Philippine J. Agr., 1933, 4: 41-59, bibl. 32.

Fully ripe and sound fruits were used in the experiments. The syrup used was prepared from first-class refined sugar. *Strawberry*.—Frozen at 18° F. in a 40-60% syrup concentration strawberries show practically no shrinkage, and slight surface discoloration in a few samples only. Colour ranged from light brown to natural red. Strawberries frozen in dry sugar, 1:1 and 2:1 at 0° F. showed much shrinkage and were darker and tougher than in syrup. In both packs the flavour was little changed. *Mango*.—Scooped out with a stainless spoon, or peeled and sliced in a syrup concentration of 40-50%, mangoes frozen at 0° F. and -40° F. for 1-6 hours, with subsequent storage at 18° F., retained good colour, flavour and texture, and were of an attractive golden colour with no discoloration. Mangoes packed dry in brown sugar turn brown and have a poor flavour. *Avocado*.—Sliced fruit in 50-70% syrup, frozen at 0° F. and -40° F. and stored at 18° F. showed slight surface discoloration, but a good colour underneath, with no lowering of quality. Freezing at higher temperatures than 10° F. resulted in a lowering

of quality in colour, flavour and texture. *Lanzones* (*Lansium domesticum*).—Seedless segments packed in a 70% syrup, frozen at 0° F. and -40° F. and stored at 18° F. gave a white fruit free from surface discoloration and of good flavour and texture. If the cores are not removed this part turns brown. Freezing in bunch with or without syrup gave good colour and flavour but a rapid browning on exposure to air. *Ales* (*Annona squamosa*=Sugar apple).—Pulp frozen with or without seeds in 20-60% syrup at -40° F. with storage at 18° F. retains the colour, texture and delicate aroma of the fresh fruit. *Guava*.—Freezing and storage at 18° F. in 70% syrup of fully ripe sliced guavas with or without seeds, or halved fruits with seeds, retained all good qualities. *Young coconuts*.—The meat is scraped out or grated, the red skin not being included, and packed with 40-50% sugar syrup or with a syrup of coconut water. Frozen at 0° F. or 18° F. it gives a product of good colour and texture resembling coconut sherbet in flavour. *Pineapple*.—Sliced pineapple in 50% syrup frozen at 18° F. gave good colour, texture and flavour and retained the proteolytic enzyme which is destroyed in canned fruit. *Nangka* (*Artocarpus integrifolia*=Jack fruit) and *lemasa* (*Artocarpus Champeden*).—Pulp, with the seeds removed, frozen at 18° F. in 50-60% syrup retained the flavour, colour and texture of the fresh fruit. *Chico* (*Achras Zapota*=Sapodilla).—Ripe but not soft chicos, peeled, sliced, cored and with seeds removed, packed in 40% syrup, retained the qualities of the fresh fruit without discoloration or shrinkage when frozen at 0° F. *Zapote* (*Diospyros Ebenaster*=Black Sapote).—The pulp passed through a 40 mesh sieve [60 mesh elsewhere in article.—Ed.] and packed with plain sugar 1 : 1, 2 : 1 or 3 : 1 and frozen at 0° F., retained the flavour of the fresh fruit. The article also discusses types of container and the uses to which the preserved fruit can be put. [The abstractor is responsible for the identifications appearing in brackets.]

137. DIEHL, H. C. 664.84/85.037
Some factors in the freezing preservation of fruits and vegetables.
Northwest Fruit Grower, 1933, 5 : 10 : 7, bibl. 5.

During 1931-2 studies were made of the behaviour of fruit and vegetables packed in non-airtight containers of about 1 lb. capacity and held at various freezing temperatures. The importance of the physiological response of the plant to low temperatures and to ice formation and its relative specificity extending even to varieties of the same product was established. For instance asparagus retained its flavour and appearance best at -20° F. while apples impregnated with syrup by a vacuum-syrup treatment were preserved best at 20° F. Between different varieties of the same product in some cases wider variations in response were found to exist than could be brought about by considerable modification of the freezing preservation methods. Further research is needed on the fundamental phases of ice crystal formation and its relation to structural and physiological alterations in protoplasm and in devising efficient methods of obtaining rapid and uniform heat transfer in horticultural products to be preserved at moderate freezing temperatures. Blackberries, strawberries and raspberries stored at 15° F. or 20° F. show, particularly in sealed containers, a more reduced microbial content than when stored at -5° F. In a sealed can held at 15° F. for 6 months, 99% of the micro-organisms may be killed, whereas at -5° F. it may take a year to kill only 60%, a difference almost certainly due to the accumulation of CO₂ from the respiration of the berries. [This paper was presented at the annual meeting of the Washington State Horticultural Association, date not specified.—Ed.]

138. WARDLAW, C. W. 664.85.653
Preliminary observations on the storage of avocado pears.
Trop. Agriculture, 1934, 11 : 27-35, bibl. 9.

The West Indian avocado is very much less resistant to cold than the Californian fruit. The latter can be held at temperatures as low as 40° F. for considerable periods, whereas of the 33 Trinidad varieties used in the investigations 22 were not sufficiently cold-resistant to stand a temperature of 40°-53° F. for a period of 15-20 days and all except 3 to withstand a temperature of 40° F. or 45° F. without internal discoloration. This internal discoloration is a definite physiological disease, comparable with the internal breakdown of other fruits and is a direct result of over-refrigeration. The critical temperature for most West Indian avocado fruits

appears to lie between 50°-60° F. which is not sufficiently low to retard maturation beyond 12-15 days, and even after 8-10 days the fruit becomes so rapidly over-ripe on transference to a higher temperature that marketing for retail is impossible. From the fact that 11 varieties showed better keeping quality, ripening up normally at 70° F. after 15-20 days at 40° F., it is thought that a number of types may be obtained which will bear refrigerated transport to distant markets. Exact information is not yet available as to the degree of maturity at picking most suitable for long distance transport. The same applies to length of pre-storage delay after picking. The margin of safety will undoubtedly vary with the variety. In tests of rate of cooling it was found that even in the course of 8-10 days crated fruit was not brought down to the temperature of the room, 40° F. and 45° F. This lag in the cooling of packs may result in wastage in large bulk consignments through over-ripening of the fruit in the inner, non-marginal crates which will be at a temperature of at least 5° F. above that of the circulating air. The fruit can stand relatively high concentrations of CO₂ without external or internal damage and the author considers that it should lend itself to preservation by gas storage methods in conjunction with refrigeration. Fungal wastage in stored fruit appeared to be very slight, the purple variety on the whole being less affected than the green.

139. MACGILLIVRAY, J. H.

664.84.65.036

Effect of heat on red and yellow tomato pigments.*Gartenbauwissenschaft*, 1933, 8: 322-7, bibl. 3.

During the sterilization of canned tomatoes and tomato products a considerable loss of colour occurs, which is apparently due to the heating. Tests on the effect of sterilizing after removal of sugar did not on the whole show any definite improvement in retention of colour. Photomicrographs show the changes induced in the red pigment crystals (lycopin) and in the yellow pigment crystals (carotinoid) by heat. It is found that the colour of pulp made from yellow tomatoes is preferred to that of the original sample, but that in red tomatoes the pulp is always poorer in colour than the original sample when concentrated at the temperatures used in open tanks.

140. KESZLER, H.

664.85.035.1

Ozon, ein Hilfsmittel bei der Kühlagerung von Obst. (Ozone as an aid to the cold storage of fruit.)*Mitteilung der Eidgen. Versuchsanstalt für Obst-, Wein- und Gartenbau in Wädenswil*, 1933, pp. 3.

An account of elementary experiments on the use of ozone in fruit storage. Some 10 lots of 30-40 kg. of apples were subjected to ozone for 2 hours twice daily, both they and the control being kept at a temperature of 0° C. and in an atmosphere containing 70-73% humidity. Results in most cases favoured the treatment and indicated that it was responsible for a large reduction in breakdown due to fungal infection. Its action would appear to check not only the vegetative growth of the fungus, but also spore formation.

PACKING, PROCESSING, FRUIT PRODUCTS.

141. DREYER, D. J., AND PUTTERILL, V. A.

634.13-1.564

Case packing of pears for export.*Union of S. Africa Dept. Agr. bull.* 124, 1933, pp. 58.

Before dealing with the problem of packing, the authors note the kinds and quantities of pears exported yearly from the Union. Pears account for more than 25% of all the fruit exported. Over 30 pear varieties are exported, 5 of them, namely Beurré Bosc, Williams Bon Chrétien, Glou Morceau, Louise Bonne, and Winter Nelis accounting for 60% of the crop. It is noticeable

also that the exports of Doyenné du Comice are increasing very rapidly and in the 1931-32 export season were third highest. A very full account is given of fruit sizing methods and appliances, and an estimate is made of their accuracy. The degree of uniformity in the sizing of the fruits in any one package necessary to get a good pack is discussed. A full description is given of how to pack the multiple layer pack. A comprehensive range of counts and packs is given for the "Californian" pear box, and for the "Bushel" box. The results of preliminary experiments on the effect of packing with varying degrees of tightness are given and discussed. The illustrations and diagrams in this most helpful article are numerous and clear.

142. CHARLEY, V. L. S. 663.3
New products from English fruits.
Food Manufacture, 1933, 8 : 371-3, and 9 : 11-16.

Various products which can be manufactured from English fruits are discussed, and methods of manufacture described. The subjects dealt with here are:—(1) fruit juices, extraction and filtration; (2) syrups, preparation and use; (3) fruit concentrates prepared by the vacuum distillation method; (4) fruit wines, general methods of manufacture; (5) fruit liqueurs. The writer claims to have made "some remarkably good liqueurs" in quite a simple manner (described) from loganberry and from strawberry. The object of the article is to point out ways in which surplus soft fruits or fruits which do not reach a profitable market standard of quality may be utilized instead of wasted. The products discussed above were prepared under a scheme carried out at the Long Ashton Research Station.

143. BARKER, B. T. P. 663.3-1.57
A note on the uses of pomace.
J. Min. Agr., 1933, 40 : 710-5.

The increased interest in cider making in the Empire means a greater interest in the disposal of its by-products. In this article the use of pomace is discussed as a source of pectin, as a food for stock and as a manure. As regards pectin it is noted that until new uses of pectin are discovered the present output of dried pomace tends to be in excess of the pectin demand. As a food for stock it is known to be valuable, but exact experiments are lacking in most cases. As a manure in conjunction with lime and mixed with farmyard manure it has been applied with good effect as a top dressing in cherry orchards. Again experimental evidence as to its value and mode of use in this capacity is not yet available.

The following also is noted:—

ADRIANO, T., AND OTHERS. **The value of Philippine fruits and vegetables for the preparation of fermented and unfermented pickles.** *Philippine J. Agriculture*, 1933, 4 : 13-30, bibl. 6.

NOTES ON BOOKS AND REPORTS.

144. ZHUKOVSKY, P. 633/635
La Turquie Agricole. (Partie Asiatique-Anatolia.) (Agricultural Turkey. Asiatic section—Anatolia.) [Russian—French summary.] Académie Lénine des Sciences Agricoles de l'URSS, Institut de Production Végétale, Leningrad, 1933, pp. 908, of which 136 are in French, bibl. 28.

The book records the results of three expeditions made by the author (who was Director of the Botanic Garden at Tiflis) to Anatolia in 1925-27. The work was sponsored by Professor Vavilov and forms a link in a chain of similar collecting expeditions into surrounding countries sent out with the intention of establishing a vast phytogeographic and genotypic museum of living plants

which will eventually include examples of every cultivated variety and the species from which cultivated varieties may have sprung. Thus there will be ready to hand both a storehouse to which the plant breeder may confidently resort in search of any required character and a nucleus from which selected varieties may be propagated and introduced directly into Russian agriculture. The author, who states that he worked entirely single-handed, sent home more than 10,000 samples. He considers Anatolia to be the cradle of many of the most valuable plants used in European agriculture, and that the potentialities of Anatolian plants in the hands of the selectionist and plant breeder are unlimited. The local varieties of fruits such as pear, sweet and sour cherries, almonds, plums, olives, figs, caroubs and nuts he considers to be the direct descendants of the wild varieties which are still to be found in the forests of the country. For the plant breeder who can read Russian the book should prove of considerable value if only for the detailed analyses of the character and potentialities of the many varieties described. A certain political bias does not appreciably detract from the value of the book.

145. WYE. 63(072)(05)
Journal of the South-Eastern Agricultural College, Wye, Kent,
 No. 33, 1934, pp. 87, price 2s. 6d. post free.

In this account of general progress, reports are submitted from the different departments, the advisory and experimental work being considered separately. In the Entomological Department experiments are in progress on *Anthonomus rubi*, various winter washes, new insecticide-fungicide combinations, pyrethrum (selection and spacing of plants), biologic control of *Eriosoma lanigerum* by *Aphelinus mali*, life history and control of *Argyresthia conjugella*, mushroom pests. The Mycological Department is conducting experiments on *Pseudoperonospora humuli*, *Venturia inaequalis* and *V. pirina*, hop virus diseases, mushroom diseases, fungicides and immunity of hops to *Sphaerotheca humuli*. Notes are given on the hop investigations. Work continues on the chemistry of various insecticides and fungicides. The Botanical Department is proceeding with its identification of apple and later pear varieties by their inflorescences.

146. WEST INDIES. 634/5(063)
West Indian Inter-Colonial Fruit and Vegetable Conference, report, recommendations, and proceedings, Jamaica, 1933, pp. 45.

The Conference was convened by the Secretary of State for the Colonies to review the present position of the West Indian Fruit and Vegetable Industries and to consider the formulation of a co-ordinated policy for their further development. Twenty-two recommendations were adopted, a selection of which are abstracted below. To supply the protected markets of U.K. and Canada, 75% of future *grapefruit* plantings and top workings should consist of Marsh and the remainder of Foster and Duncan until such time as the superiority of any other variety shall have been established by experimental work of Departments of Agriculture. Trees bearing superior strains of these chosen varieties should be selected by Departments of Agriculture for the supply of budwood to approved nurseries. Cultivation of oranges should be confined to localities suited to the following early and late fruit, which alone should be grown, namely Parson Brown, Late Valencia, Washington Navel. The varieties Lue Gim Gong, King and Temple should undergo trials. Further plantings of *limes* and *lemons* should be discouraged. *Tomato* cultivation should be extended to supply the Canadian market from March to June. Certain West Indian colonies already supply this market adequately during the remaining months. For them the varieties Globe for early and late and Bonny Best for late planting are recommended. Mangoes are still a luxury trade in U.K. Exports should be limited and confined to the varieties Jamaica, Bombay and Julie, suitable for cultivation in dry and wet areas respectively. *Pineapple* growing should not be extended pending the results of the recently established cannery in British Guiana. Other fruits and vegetables discussed as possible exports are still in the experimental stage. The remainder of the recommendations deal with commercial organization.

147. PALESTINE.

634(058)

Report of the Department of Agriculture and Forests for the years 1931 and 1932. Jerusalem (undated), pp. 239.

This report (received March 1934) covers the many activities of the Department very fully. The results of certain experiments are noted below. *Horticultural Service*, pp. 61-72. *Deciduous fruits*.—With due consideration given to stock and scion the following deciduous fruits appear to do well in the rocky soils of Jerusalem. Apricots, Blenheim, Gloire de Port-Alis, Royal, on almond. Peaches and nectarines on almond. The results from peach stock are not yet available. European and Japanese plums on almond, myrobalan and an unknown stock give excellent results. The most successful varieties are Bon-Ouvrier, Neron, Victoria, Reine Claude and of the Japanese, Santa Rosa, Satsuma, Wickson. Cherries, except Morello, are poor. Pears are suffering from the lack of a suitable stock. Apples on Doucin are healthy, the fruit medium sized, aromatic, juicy. The best varieties are Reine des Reinettes, Transparente de Croucels, Calville Blanc, Duchesse d'Oldenbourg, White Transparent. Wild and local fruit seeds were sown in the hope of obtaining more suitable rootstocks. *Prunus Cerasia* BL, the Ajas plum, the Swedah plum (both wild forms of *Prunus domestica*), *P. ursina* and *Sorbus trilobata* all gave very poor germination. *Pyrus syriaca*, the almonds and the native peach germinated well. *Bananas*.—Irrigation experiments showed that 2 irrigations a week, 44 waterings during May to September at the rate of 2,902 cm. per dunam (about $\frac{1}{4}$ acre) produced healthier and more vigorous plants than 1 irrigation per week at the rate of 1,736 cm. per dunam per year. *Dates*.—Experiments in the propagation of dates from offshoots showed that the following conditions were necessary for the highest success:—the offshoots must be pruned, seasoned for a few days, planted in light soil, shaded, and irrigated twice weekly. *Olives*.—On analysis Palestinian olives were found to be poorer in fats, proteins and ashes than others. This inferiority is attributed to lack of proper manuring and a number of manurial trials have been laid out to ascertain the effects of different fertilizers on the quality of the oil. Research is in progress in co-operation with the Jewish Agency Experiment Station at Rehovoth on the keeping quality of oranges and their relation to external factors. Results are not given. *Almonds*.—Experiments in bleaching almonds proved the superiority of the method by which the kernels are immersed for 10 minutes in 0.5% sulphurous acid over the local method of burning sulphur.

148. UGANDA.

634.58 + 633.73 + 631.874

Annual Report of the Department of Agriculture for 1932, part 2.

Entebbe, Uganda, 1933, pp. 81, price 5s.

This document consists of a series of reports on the experimental work conducted during the year 1932 by the officers of the Agricultural Department. *Groundnuts*.—Spacing experiments showed higher yields with closer spacing without so far an indication of the optimum spacing. The bunch type is inherently less susceptible to rosette disease than the spreading type, but close planting which acts as a very definite check on the disease is necessary. *Coffee*.—Pruning experiments on single stem, multiple stem and Agobiada systems resulted in the latter system giving the highest yield over four years with no significant differences between the other two. Manurial experiments (a) clean weeded, (b) green manure, two covers per annum, (c) banana leaf mulch, (d) ordinary weed cover, (e) leguminous cover crop from October to March and clean weeded for the rest of the year, showed (d) as significantly the worst, and (e) as better than (a), (b), (d), with no significant differences between the other treatments. On page 79 there is a brief description of six methods of pruning coffee which should prove useful for reference. *Cover crops*.—The cover crop *Stizolobium Deeringianum* [Florida velvet bean.—ED.] proved one of the best. It produces a mass of mulch in nine months and seeds freely. A sowing rate of 16 lb. per acre planted 3 ft. \times 3 ft. produced 1,400 lb. of seed. *Centrosema pubescens* planted from setts proved capable of smothering all weeds except a *Euphorbia* sp. It appears likely to stand for a number of years. There are very many other experiments described in the course of the report, to which reference is not made here, because either they are not sufficiently mature for conclusive results or they concern crops or experiments which are dealt with by others of the Imperial Agricultural Bureaux.

149. IMPERIAL BUREAU OF FRUIT PRODUCTION.

634.75-2.1/7

The "degeneration" of the strawberry.*I.B.F.P. tech. comm.* 5, 1934, pp. 28, bibliographies 43, 46, 31, 41, price 2s.

This contains a foreword by B. T. P. Barker and four sections as follows :—(1) The pomological aspect of strawberry degeneration, by D. Akenhead. (2) Virus as one cause of strawberry degeneration, by R. V. Harris. (3) The phenomenon of root rots in connection with strawberry degeneration, by G. H. Berkeley. (4) The insects and other animals associated with degeneration of the strawberry, by A. M. Massee.

The following also is noted :—

CAMBRIDGE SCHOOL OF AGRICULTURE. **Summary of papers published by the staffs of the School of Agriculture and its associated research institutes . . . May 1st, 1932-April 30th, 1933.** *University of Cambridge School of Agriculture Memoirs*, No. 5, 1933, pp. 44, 1s.

HORTICULTURAL EXHIBITION

THE VICTORIA CENTENARY CELEBRATIONS

Melbourne, Victoria, Australia

A HORTICULTURAL EXHIBITION in the FITZROY GARDENS near MELBOURNE will form part of these Celebrations held. OPENING DATE 23rd OCTOBER, 1934. Attendance and exhibits are solicited. Conferences will be held on important horticultural subjects.

Further particulars from :

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